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MISA
Municipal/Industrial Strategy for Abatement

# DEVELOPMENT DOCUMENT

# FOR THE EFFLUENT LIMITS REGULATION

# FOR THE

# MISA IRON AND STEEL MANUFACTURING SECTOR

Ontario

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# DEVELOPMENT DOCUMENT FOR THE EFFLUENT LIMITS REGULATION FOR THE MISA IRON AND STEEL MANUFACTURING SECTOR

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# Foreword

The Municipal/Industrial Strategy for Abatement (MISA) is Environment Ontario's program to reduce the discharge of toxic contaminants to Ontario's waterways. Under the first phase of MISA, dischargers were required to monitor and report on the contaminants present in their effluent streams. This information has subsequently been used to set legal discharge limits requiring reductions in toxic discharges to the level attainable with the best available pollution control technology which is economically achievable. The ultimate goal of the MISA program is the virtual elimination of persistent toxic contaminants from all discharges into Ontario's waterways.

This document contains the technical foundation for legal effluent discharge requirements for Ontario's Iron and Steel Sector. These requirements are specified in "Ontario Regulation 214/95: Effluent Monitoring and Effluent Limits - Iron and Steel Manufacturing Sector". The regulation is issued under the Ontario Environmental Protection Act (Section 136).

This document consists of six chapters.

The first chapter of this document is introductory and presents the environmental background to MISA and the main features of the program. A description of the Effluent Monitoring Regulation for the Iron and steel sector is given and the generic effluent limits regulation development process is explained.

Chapter two presents information about each Iron and Steel plant including location, production capacities, processes used, wastewater sources, and the characteristics and treatment of plant effluents.

The third chapter contains a summary of the data collected as part of the Effluent Monitoring Regulation for the Iron and Steel Sector. The results of the data evaluation including the quality control and quality assurance are presented together with the selection of a list of parameters for which effluent limits were sought.

The fourth chapter deals with the assessment of pollution control technologies suitable for the iron and steel manufacturing operations and wastewater characteristics, leading to the identification of those technologies considered to be the "best available". Chapter four also examines the economic and financial implications of each of the "best available" technology (BAT) options, and presents the likely impact of each BAT option on individual dischargers and the sector as a whole.

Chapter Five presents the basis for the development of effluent limits attainable through the application of the Best Available Technology Economically Achievable. Included in the chapter is a review of existing pollution control requirements with which the iron and steel plants must comply, along with a comparison of the MISA Effluent Limits for the Iron and Steel Sector with effluent limitations, standards, and guidelines from other jurisdictions.

The sixth chapter explains the compliance requirements of the Effluent Limits Regulation for the Iron and Steel Sector.

## Executive Summary

This document describes the development of the Effluent Limits Regulation for the Ontario Iron and Steel MISA sector plants.

The Limits Regulation, made under the Ontario Environmental Protection Act has been developed through discussion and consultation with Environment Canada, the public and industry.

The regulation specifies daily and monthly average limits for twelve contaminants for the integrated steel plants, four contaminants for the mini-mills and five contaminants for the specialty steels plant. The regulation also specifies pH range for all the plants and requires that all sector plant effluents shall be non-acutely lethal.

The parameters to be limited for the integrated steel plants, mini-mills and speciality steels are outlined below:

- Cyanide Total
- Ammonia plus Ammonium
- Total Suspended Solids
- Total Chromium
- Total Lead
- Total Nickel
- Total Zinc
- Phenolics (4AAP)
- Benzene
- Benzo(a)pyrene
- Naphthalene
- Oil and Grease

The basic principle of the Limits Regulation is the development of technology-based limits for each process subcategory of the iron and steel sector. The limits will control the levels of each process related toxic contaminant through the application of Best Available Technology Economically Available (BATEA).

From the best available technology for each process subcategory found in Ontario and the United States (U.S.), as well as the technology train recommended by the Effluent Limits Setting Subcommittee (ELSS), the following options were applied to the Ontario iron and steel plants:

Option 1. BAT in Ontario applied to each process subcategory

Option 2. BAT in U.S. applied to each process subcategory

Option 3. BAT in the world (combination of best technology found in Ontario and U.S.) applied to those processes that were the major sources of persistent toxic substances

Option 4. BAT recommended by the ELSS applied to those processes that were the major sources of persistent toxic substances

The capital and operating costs for each option applied to the sector were:

| Capital and Operating Costs | | | |
|---|---|---|---|
| **Option** | **Capital Cost ($'M)** | **O & M Costs ($'M/yr)** | **After-Tax Annualized Cost ($'M/yr)** |
| **Option #1** | 347.7 | 51.9 | 66.3 |
| **Option #2** | 343.3 | 48.4 | 62.4 |
| **Option #3** | 182.5 | 23.5 | 32.5 |
| **Option #4**[1] | 118.5 | 11.3 | 18.8 |

Option 4 was recommended to develop effluent limits for the sector since it was the most cost effective option for all the plants.

The results of individual comparisons of the three firms' projected 1994 profit performance with their "after-tax" annualized compliance costs show that the estimated compliance costs would account for 4.8%, 3.9% and 21.5% of the 1994 profits of Algoma, Dofasco and Stelco, respectively.

The effect of the estimated costs on the non-integrated mills is minimal. These mini mills constitute the only segment of the Iron and Steel Sector to have returned a profit in each of the last three years.

Ontario's iron and steel industry returned to profitability in 1994 with all three firms making a profit following the recession. Higher product prices and strong demand from the buoyant automotive industry are identified as reasons for the improved performance.

---

[1] Includes the recommended option for the mini-mills and specialty steel mill.

The estimated compliance costs for the recommended effluent limits would be less burdensome on the sector firms now, than at any period in the previous three years. Furthermore, growth in product demand would provide sector firms the required funds to further invest in facilities and products upgrading, investments needed if Ontario steel mills are to remain competitive. MISA-induced expenditures would coincide with these cycle infrastructure investments.

At the height of the recession between 1989 and 1993, Canada's iron and steel industry invested $2 billion in facilities' upgrades. Iron and steel is a cyclical industry that is currently experiencing an upswing in demand. In 1993, shipments in iron and steel increased by an annual rate of 9%.

The technology train for each process subcategory included in option 4 is described below:

Cokemaking: Tar removal, Equalization, ammonia stills, pH adjustment followed by biological oxidation, clarification and filtration.

Ironmaking: Recirculation of the blast furnace scrubber water system, followed by filtration.

Steelmaking and Vacuum Degassing: Recirculation of scrubber water followed by chemically assisted metals removal and filtration.

Continuous Casting and Hotforming: Since these operations do not generate persistent toxic pollutants, the existing technology train for the continuous casting and hotforming at the Ontario plants were used without retrofitting. The technology train has the components of best available technology (settling basins followed by filtration).

Finishing: The waste streams from acid pickling, cold forming, alkaline cleaning, hot coating and electrolytic plating are pre-treated prior to a central treatment. The oily wastewater is treated in a flow equalization tank followed by oil separators. The oil is further separated in a dissolved air floatation. Chrome wastewaters are treated through ion exchange. Final combined treatment of alkaline and acidic rinsewaters as well as scrubber waters (from acid regeneration plants) are treated through chemically assisted metals removal followed by clarification and filtration.

The proposed Iron and Steel Manufacturing regulation would decrease the total loadings of conventional (i.e. TSS and Oil &

Grease) and non-conventional (i.e. ammonia, cyanide and phenolics) and toxic contaminants (i.e. benzene, benzo(a)pyrene and naphthalene) discharges by the plants in the sector by approximately 3,600 tonnes per year distributed as follows:

- conventional contaminants = 2,693 tonnes/yr
- non-conventional and toxic contaminants = 907 tonnes/yr

The expected annual loading reductions for the sector will include 54% (from 5,034 to 2,341 tonnes/year) for the conventional contaminants and 81% (from 1,122 to 215 tonnes/year) for the non-conventional and toxic contaminants.

The toxic organic compounds which are generated from the cokemaking operations are expected to be reduced by 93% (from 2188 kg/year to 147 kg/year.

Both Hamilton Harbour and the St. Mary's River have been identified by the IJC as Areas of Concern needing immediate attention and clean up. Through the signing of the Great Lakes Water Quality Agreement, both the Federal and Provincial Governments are required jointly, to develop Remedial Action Plans (RAPs) to identify the problems and outline activities needed to delist the area from being an Area of Concern. Development of the MISA Regulations is a key component to the development of the Ontario plans for the St. Marys River and Hamilton Harbour since:

- There will be reduced concentrations of toxic chemicals being discharged and thus accumulation in the bottom sediments will be reduced.

- Transboundary water pollution from Algoma Steel to the Michigan shoreline of the St. Mary's River will be reduced.

- Taste and odour problems in drinking water and fish will be reduced.

# Chapter 1
# The MISA Initiative

## 1.1 The MISA Initiative

The MISA program was officially announced by the Ontario Ministry of the Environment in the White Paper of June 1986[1]. MISA is a regulatory program for reducing water pollution from both industrial and municipal dischargers. Initially, technology-based effluent limits will be imposed on each discharger as a minimum pollution control requirement. In addition, more stringent effluent limits can be superimposed on dischargers on a site-specific basis to protect local sensitive receiving waterbodies. The ultimate goal of MISA is the virtual elimination of persistent toxic contaminants from all discharges into Ontario's waterways.

The strategy for achieving that goal include:

- Setting effluent limits for certain sector-specific pollutants.
- Ensuring that industrial effluent does not kill fish.
- The development of a list of specific persistent toxic substances for possible ban or phase-out in Ontario.
- Requiring Industry to reduce those persistent toxic substances not specifically slated for ban and phase-out.

The process to develop technology-based effluent limits involved two phases. In the first phase, effluent monitoring regulations were legislated which required dischargers to monitor their point source effluents at regular intervals according to specific sampling, analytical, quality control, and quality assurance protocols and procedures. The second phase involved the development and implementation of effluent limits regulations for each of the industrial and municipal sectors, using data collected under the monitoring regulations.

The Effluent Monitoring Regulations required dischargers to monitor their point source discharges at regular intervals. This monitoring was intended to provide comprehensive data on effluent quality, particularly for toxic contaminants. In order to accurately reflect all discharger operating conditions, the effluent monitoring regulations required sampling at various frequencies over an entire year using specified standard procedures. Industry's self-monitoring under the regulations was subjected to independent audits carried out by the Ministry of the Environment.

Information generated by the effluent monitoring regulations produced a data base on contaminants discharged across Ontario. These data were evaluated and used in the development of effluent limits based on the best available pollution control technology which is economically achievable (BATEA).

Issue Resolution Committees (IRCs) consisting of representatives of industry, municipalities, Environment Canada, the MISA Advisory Committee and the Ministry were established to develop a consistent criteria and a process to be followed by the Joint Technical Committees (JTCs) to adopt in setting effluent limits for the nine MISA industrial sectors.

The final IRC reports on each of the issues were summarized in a Ministry Summary Report[2] released in September 1991.

## Joint Technical Committees

The Ministry adopted an open consultative process both with industry and the public in developing the Iron and Steel Sector effluent Limits Regulation.

The Iron and Steel Joint Technical Committee and subcommittees (Data Evaluation subcommittee, Effluent Limits Setting Subcommittee) consisted of representatives from the industrial sector, Environment Canada, the MISA Advisory Committee and the Ministry. Members of the MISA Advisory Committee were appointed by the Minister of the Environment on the basis of their knowledge, concern and expertise in matters dealing with the environment.

The function of the joint technical committees was to discuss all of the issues and concerns in order to arrive at an agreement acceptable to all parties.

## Public Review

The draft effluent Limits Regulation, this development document, quality control/quality assurance and the Best Available Technology reports are released for a 60-day public review period. The 12-month monitoring data report was publicly released in September 1991.

## 1.2 Development of the Effluent Limits

The general process which was followed in developing the Effluent Limits Regulation for the Iron and Steel Sector was initially provided in the MISA White Paper[1]. Below, each step is briefly described.

**Step 1.** Under the Effluent Monitoring Regulation, dischargers were required to monitor for a comprehensive list of contaminants. Statistical tests were applied to the monitoring data to identify/confirm which contaminants from that list were absent from the effluents. Those parameters determined to be absent were not considered for the purpose of setting limits at this time.

**Step 2.** Quality assurance/quality control assessment was carried out for the parameters that were confirmed to be present. This provided a measure of the accuracy and precision, and hence the reliability of the monitoring data. Data which were considered of unreliable or equivocal quality were eliminated from further consideration in the limit setting process.

**Step 3.** The available pollution control technologies were evaluated on the basis of the number, kind, and toxicity of contaminants which they treated, and the contaminant reductions achieved. A short list of technologies representing different levels of control, and their costs, was identified through this process. This list of technologies constituted the potential best available technologies (BATs) for the iron and steel sector.

**Step 4.** Information about estimated pollutant removal efficiencies and costs of the various potential BATs, provided in Step 3, was used to derive abatement cost functions which show the relationship between increasingly stringent levels of control and the cost of achieving them. Financial and economic consequences associated with the various levels of control were also estimated. All of the information on technologies and economic and financial impacts were used when choosing the "best available technology economically achievable", BAT(EA), upon which the effluent limits are based.

**Step 5.** Once BAT(EA) had been selected, discharge limits were set. These will be imposed on the contaminants which the BAT(EA) can treat and at levels which the BAT(EA) can achieve.

**Step 6.** Under the regulation, dischargers must not only meet the limits, but must also ensure their effluents meet toxicity requirements. The toxicity testing requirements stipulate the frequency and procedure that must be followed by the sector plants when testing their effluents.

# Chapter 2
# Sector Profile

## 2.1 General

The primary steel industry is the sixth leading industrial group (of a total of 109) in Canada in terms of value added. Based on 1986 data, the industry accounted for 2.7% of the value added in Canadian manufacturing and 7.3% of the value added to the provincial manufacturing. The integrated and non-integrated steel mills constitute the predominant portion of this primary steel industry, contributing 94% of the total value added or $2.8 billion worth to the Canadian economy. (Statistics Canada (31-203) 1986).

The presence of the integrated and non-integrated steel mills is of crucial importance to the southern Ontario economy. It has strong links with this area's heavy concentration of automotive vehicle, parts and accessories industries.

There are seven iron and steel mills in Ontario which fall under the MISA Initiative for direct dischargers in the Iron and Steel Industry: four integrated mills, and three non-integrated mills (Specialty and Mini Mills).

The integrated mills are: Algoma Steel Corporation, Limited (Algoma), Dofasco Inc. (Dofasco), Stelco Inc., Hilton Works (Stelco Hilton), and Stelco Inc., Lake Erie Works (Stelco LEW). The non-integrated mills are: Atlas Specialty Steels (Atlas), IVACO Rolling Mills (IVACO), and Lake Ontario Steel Company (LASCO).

Table 2.1 lists the location, major products, 1993 raw steel production, wastewater discharge flow rate and location for each mill.

## 2.2 Sector Overview

The Ontario steel industry has changed significantly in the early 1990's due to the decline in the demand for steel and due to the substitution away from steel. The employment by the Ontario steel industry has fallen from 33,000 workers in 1989 to 22,000 workers in 1993. The restructuring that took place during this period entailed the closure of:

- Dofasco's No.1 production stream which included No.1 Blast Furnace, No.1 Melt Shop, No.1 Hotforming Mill, #1

Pickle Line and various temper/cold mills.

- Atlas Speciality Steel's acid pickling facilities.
- Algoma Steel's No.2 Melt shop.
- Stelco Hilton Works' Universal Slab Mill (a hotforming mill)

**Subcategorization of the Iron and Steel Processes**

In order to accurately reflect the production operations in the sector, production-based subcategorization was used. This subcategorization was also necessary since the wastewaters of the various processes contain different pollutants requiring various treatment trains.

Therefore, on the basis of the discrete production units at the sector plants, the following major process subcategories were selected:
Cokemaking
Sintering
Ironmaking
Steelmaking
Vacuum degassing
Continuous Casting
Hot Forming
Finishing

This subcategorization approach was similar to that adopted by the United States Environmental Protection Agency (U.S.EPA[3]) with the exception of the finishing operations where U.S.EPA divided the finishing subcategory into several segments such as acid pickling, cold rolling, electroplating and hot coating. In this document, the acid pickling production is selected as the base production rate for the finishing operations since all steel processed must be pickled. Ratios of production of finishing operations to pickled production indicated a reasonably good agreement for the hot coating and electroplating operations.

A summary describing each process subcategory at each plant is included in Appendix I.

## 2.3 Water Use

The Iron and Steel Sector plants use large volumes of water in the manufacture of their products. The seven Iron and Steel Manufacturing Sector plants discharge approximately 1.3 million $m^3$/day of process effluent and 1.6 million $m^3$/day of cooling water effluent into Ontario waterways. The plants of Algoma Steel Inc. (Sault St. Marie), Stelco Hilton Works (Hamilton), and Dofasco Steel (Hamilton) account for more than 70% of the total sector flow.

Water usage in each plant in the Sector is shown in Table 2.1.

## 2.4 Control and Treatment Technology

This section identifies and describes the wastewater control and removal of conventional, non-conventional and toxic pollutants discharged by the Iron and Steel Sector.

Many Ontario Iron and Steel plants have implemented several remedial measures such as water reuse and recycle and end-of-pipe wastewater treatment to reduce or eliminate pollutants discharges from their facilities. The following is a brief summary on the wastewater treatment technologies that are presently demonstrated within the steel Industry.

### Recycle Systems

High recycle rates are applied at several process subcategories in Ontario iron and steel plants. It should be pointed out that at high recycles, two problems can be encountered. First, if the wastewater is contaminated, a build-up of dissolved solids in the recycled water can cause plugging and corrosion. This problem can be avoided by providing sufficient treatment of the wastewater prior to recycle, by adding chemicals that inhibit scaling or corrosion and by having sufficient blowdown to limit the build-up of dissolved solids and other pollutants. The second problem that can occur is excessive heat build-up in the recycled water. If the temperature of the water to be recycled is too high for its intended purpose, it must be cooled prior to recycle. the most common method of reducing the heat load of recycled water is with mechanical draft cooling towers. Mechanical draft evaporative cooling systems are capable of handling the wide range of operating conditions.

### Chemical Precipitation and Sedimentation

Chemical precipitation is a principal technology to remove metals. Hydroxide precipitation is the conventional method of removing metals from wastewater. Caustic soda (NaOH) or lime is added to the wastewater to adjust the pH to the point where metal hydroxides exhibit minimum solubilities and are thus precipitated.

Chemical precipitation is carried out in three phases:

1. Addition of chemicals followed by rapid (flash) mixing to distribute the chemical uniformly into the wastewater;

2. Flocculation which is achieved through slow stirring to promote particle growth;

3. Clarification or filtration to remove the flocculated solid particles.

**Chemical Oxidation**

Chemical oxidation using chlorine as a means for cyanide destruction is practised at Stelco Lake Erie Works. Cyanide destruction is the oxidation of cyanide to carbon dioxide and nitrogen. Chlorine in elemental or hypochlorite salt form is a strong oxidizing agent in aqueous solution. The chemical oxidation equipment consists of an equalization tank followed by reaction tanks. The cyanide alkaline chlorination process uses chlorine and a caustic solution to oxidize cyanide to cyanates and ultimately to carbon dioxide and nitrogen.

**Biological Treatment**

The biological treatment is used by the Industry to control ammonia, cyanide and phenolics (4AAP) and toxic organic pollutants such as PAH's in the cokemaking process subcategory operations.

Wastewaters are generated in the gas cooling processes and in the operation of by-product recovery facilities. The coke oven gas is drawn off the battery into the collecting main in which the gas is cooled by a series of flushing liquor sprays. This cooling process condenses moisture, tar and other compounds from the gas. Thus two streams are created which require further processing: a cooled coke oven gas and a contaminated water stream from many sources e.g. flushing liquor.

The cooled coke oven gas is processed through additional cooling steps, tar removal facilities, and other facilities for the recovery of light oil, naphthalene, ammonia and hydrogen sulfide. In this gas processing train, wastewaters are generated by the blowdown of primary and final coolers, ammonia absorber, light oil removal and refining plants and gas desulfurization facilities.

Tar from the contaminated flushing liquor is removed in a decanter. As the flushing liquor is recycled, moisture from the coal is condensed generating additional flushing liquor with high concentrations of ammonia, phenolics and polynuclear aromatic hydrocarbons. The excess flushing liquor is passed through ammonia stills to reduce ammonia concentrations to levels that are appropriate to the operation of the biological treatment plant.

The following data shows typical influent and effluent concentration data for parameters monitored at the biological treatment plant:

| **Parameter** | **Influent (mg/L)** | **Effluent (mg/L)** |
|---|---|---|
| Ammonia | 100-150 | 10 |
| Thiocyanate | 500 | 1 |
| Phenol | 500 | 1 |
| Free Cyanide | 10 | 1-3 |
| COD | 2400 | 200 |
| TSS | | 25-55 |

### Filtration

Filtration is a common method used by the Industry as a final treatment step to remove suspended solids, Oil and Grease and toxic metals. Filters may be pressure or gravity type; single, dual or mixed media. The removal of these pollutants is accomplished by the passage of water through a physically restrictive medium with resulting entrapment of suspended particulate. Continued filtration reduces the porosity of the filter bed as particulate matter removed from the wastewater accumulates on the surface of the grains of the media and in the pore spaces between grains. This entrapment reduces the filtration rate and increases the head loss across the filter bed. The solids are removed by "backwashing" when the head loss increases to a limiting value.

The normal operating flow rates[4] for filter plants currently in use by the Sector range from 6 to 12 $L/m^2$.sec.

The performance evaluation of several filtration facilities in the Ontario Iron and Steel plants was conducted by the Wastewater Treatment Technology Centre of Environment Canada[5].

This study entailed the sampling and analysis of influent and effluent streams of the filter plants at Atlas Steels, Dofasco and Stelco Inc. (the Lake Erie Works and Hilton Works).

## Table 2.1
## Iron and Steel Sector Mills
## Location, Products and Discharges

| Company | Location | Major Steel Products | 1993 Raw Steel Production (tonnes) | Process Effluent Discharge (m3/day) | Cooling Water Discharge ($m^3$/day) | Discharge Location |
|---|---|---|---|---|---|---|
| The Algoma Steel Inc. | Sault Ste. Marie | Plate, sheet, strip, seamless pipe& tube, structural shape & rails | 2,053,000 | 573,000 | 292,000 | St. Mary's River |
| Atlas Specialty Steel | Welland | Stainless,carbon,low and high alloy,tool, machinery and mining steels | 95,000 | 15,000 | 2,000 | Welland River |
| Dofasco Inc. | Hamilton | Flat and cold rolled, galvanized, galvalume tin plate,and silicon electrical steel | 2,240,000 | 200,800 | 709,500 | Hamilton Harbour |
| IVACO Rolling Mills | L'Orignal | Low and medium carbon: billets, wire rod | 350,000 | - | - | Ottawa River |
| Lake Ontario Steel Company | Whitby | Low carbon grade bars & alloy round bars | 702,000 | 6,800 | - | Lake Ontario |
| Stelco Inc., Hilton Works | Hamilton | Low to high carbon:<br>flat & cold rolled,<br>galvanized, tin plate,bar and rod | 2,150,000 | 474,200 | 610,500 | Hamilton Harbour |
| Stelco Inc., Lake Erie Works | Nanticoke | Hot rolled carbon for outside sale and for finishing at Hilton Works | 1,640,000 | 19,600 | 14,100 | Lake Erie |

# Chapter 3
# The Effluent Monitoring Database

## 3.1 Effluent Monitoring Data Evaluation

This chapter provides a brief description of the effluent monitoring Regulation, the evaluation of the monitoring data, the Quality Assurance/Quality Control (QA/QC), the selection of the candidate parameters for limits and typical effluent characteristics of each process subcategory of the Ontario plants.

Statistical tests were conducted on the effluent monitoring data to identify parameters as potential candidates for limits. For those parameters selected as candidates for limits, analysis of the QA/QC results indicated whether or not the monitoring results were reliable. The finalized list of parameters selected as candidate for limits is presented.

## 3.2 Effluent Monitoring Regulation

A pre-regulation monitoring program which was undertaken voluntary by the sector provided the basis for the selection of the sector parameter list and the frequency of monitoring. Appendix II outlines the parameters monitored for in the integrated mills and specialty steel and mini-mills respectively. Also included are the Regulation Method detection Limits (RMDL) as well as the Provincial Water Quality Objectives/Guidelines (PWQO/G).

The Iron and Steel sector monitoring parameter list, based on the Effluent Monitoring Priority Pollutants List (EMPPL)[6], was used to design specific monitoring requirements for characterizing the wastewater of the Steel Industry.

Monitoring data for the Iron and Steel Sector were collected and submitted by the Industry as required by Ontario Regulation 321/89 as amended to Ontario Regulation 602/89 and Ontario Regulation 139/90[7]. Monitoring under these Regulations began on November 1, 1989 and was completed on October 31, 1990.

Under the monitoring regulation each iron and steel plant monitored several process subcategories to provide industry wide effluent characteristics of all process subcategory streams. All final discharge streams were also monitored.

Under the Regulation, sixty-two effluent sampling points were monitored, comprising of 13 cooling water, 6 emergency overflow, 18 final, 11 process subcategory, 2 storage site effluent, 9 storm water and 3 waste disposal sites.

A quality assurance and quality control (QA/QC) program was also required under the Regulation. Field QA/QC samples (duplicates, travelling blank, travelling spiked blank) were collected from one process subcategory effluent stream, one final effluent stream and one cooling water stream from each plant site.

The QA/QC samples were collected on a monthly basis for those parameters which were monitored on daily, weekly and thrice weekly basis; and were collected semi annually for those parameters which were monitored monthly.

In addition, the 96 hour LC50 Rainbow Trout Toxicity Test and the 48 hour LC50 Daphnia magna Acute Lethality Toxicity Test were included in the monitoring regulation.

A detailed explanation of the rationale supporting the specific requirements of the Effluent Monitoring Regulation for the Iron and Steel Sector is also available[8].

## 3.3 Selection of Parameters for Limits

A detailed discussion on the results for all the parameters monitored for under the Iron and Steel effluent monitoring regulation is documented in the report entitled "Status Report on the Effluent Monitoring Data for the Iron and Steel Sector For the Period From November 1, 1989 to October 31, 1990"[9].

The potential candidate parameters for limit setting were selected according to the selection criteria defined in the Issues Resolution Process Final Report Summary, September 1991[2]. Table 3.1 outlines the parameters which were selected as potential candidates for limits for each plant of the Iron and Steel Sector.

Seventy-six parameters were selected as candidates for limit setting for the Integrated Iron and Steel plants and 29 parameters for the specialty steel and mini-mills. The parameter pH was not included in the candidate parameter analysis since it will be regulated within the range specified in the Effluent Limits Regulation.

## 3.4 Analysis of QA/QC Results

The suitability of the effluent monitoring data for use in the effluent limit setting process was evaluated in the report entitled" The QA/QC Assessment for the Iron and Steel Effluent Monitoring Data"[10]. This assessment process was based on the approach outlined in the MISA Issues Resolution Process- Final Report Summary, September 1991.

Forty-eight parameters were considered for limits for the integrated steel plants (Table 3.2). Eleven parameters for the mini-mills and fifteen parameters for the specialty steel mill were also considered for limits (Table 3.3). The parameters that required further evaluation before being considered for limits or removed from further consideration are outlined in Tables 3.4 and 3.5.

## 3.5 Effluent Characteristics of the Ontario Plants

Typical effluent characteristics of each process subcategory of the Ontario steel mills monitored during the effluent monitoring period in terms of long term average concentrations and loadings are outlined in Tables 3.6 to 3.12.

# Table 3.1
# Potential Candidate Parameters for Limits

| ATG | Parameter | Plant | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Algoma | Dofasco | Hilton | L. Erie | Atlas | IVACO | LASCO |
| 2 | Cyanide Total | 1 | 1 | 1 | 1 | | | |
| 4a | Ammonia plus Ammonium | 1 | 1 | 1 | 1 | | 3 | 3 |
| 4a | Total Kjeldahl Nitrogen | | 2 | 2 | 2 | | 2 | |
| 4b | Nitrate plus Nitrite | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| 5a | DOC | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 5b | TOC | 2 | | 2 | | | 2 | |
| 6 | Total Phosphorus | 1 | 1 | 2 | 2 | | 1 | 1 |
| 8 | Total Suspended Solids | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 8 | Volatile Suspended Solids | 2 | 1 | | | 1 | 3 | 1 |
| 9 | Aluminum | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 9 | Cadmium | | 3 | 2 | 1 | 1 | | 3 |
| 9 | Chromium | | 1 | | 1 | 1 | 3 | |
| 9 | Cobalt | | | | | 1 | | |
| 9 | Copper | | 2 | 3 | 3 | 1 | 1 | 1 |
| 9 | Lead | 1 | 1 | 1 | | 3 | 3 | 1 |
| 9 | Molybdenum | 2 | 3 | | | 1 | | 2 |
| 9 | Nickel | | | 3 | | 1 | | 3 |
| 9 | Thallium | | 2 | | | | | |
| 9 | Vanadium | | | 1 | | 1 | | |
| 9 | Zinc | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 10 | Antimony | | | | | 2 | | |
| 10 | Arsenic | 2 | | | | 2 | | |
| 10 | Selenium | 2 | 2 | | 1 | | | |
| 11 | Chromium (hexavalent) | | 2 | | | 1 | 2 | |
| 12 | Mercury | | | | 1 | | | |
| 14 | Phenolic (4AAP) | 1 | 1 | 1 | 1 | | | |
| 15 | Sulphide | 2 | 2 | 2 | 2 | | | |
| 16 | Bromoform | | | | 1 | | | |

NOTE:
1 = Data are of reliable quality
2 = Data are of equivocal quality
3 = Data are of unreliable quality

# Table 3.1
# Potential Candidate Parameters for Limits

| ATG | Parameter | Plant | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Algoma | Dofasco | Hilton | L. Erie | Atlas | IVACO | LASCO |
| 16 | Chloroform | 2 | | 2 | 3 | | 1 | |
| 16 | Dibromochloromethane | | | | 1 | | | |
| 16 | Methylene Chloride | | | | | | 3 | |
| 16 | Tetrachloroethylene | | | | | | 2 | |
| 16 | Trichloroethylene | | | | | | 2 | |
| 17 | Benzene | 1 | 1 | 1 | | | | |
| 17 | Styrene | | 1 | | | | | |
| 17 | Toluene | 1 | | 1 | | | 2 | |
| 17 | m-Xylene and p-Xylene | 1 | 1 | 2 | | | | |
| 17 | o-Xylene | 1 | 2 | | | | | |
| 19 | 1-Chloronaphthalene | | 2 | | | | | |
| 19 | 1-Methylnaphthalene | | 1 | | | | | |
| 19 | 2,4-Dinitrotoluene | | 1 | | | | | |
| 19 | 2,6-Dinitrotoluene | | 1 | | | | | |
| 19 | 2-Chloronaphthalene | | 2 | | | | | |
| 19 | 2-Methylnaphthalene | | 1 | | | | | |
| 19 | 4-Bromophenyl Phenyl Ether | | 1 | | | | | |
| 19 | 4-Chlorophenyl Phenyl Ether | | 1 | | | | | |
| 19 | 5-Nitro Acenaphthene | | 2 | | | | | |
| 19 | Acenaphthene | | 2 | | | | | |
| 19 | Acenaphthylene | 1 | 1 | | | | | |
| 19 | Anthracene | 1 | 2 | | | | | |
| 19 | Benzo(a)anthracene | 1 | 3 | | | | | |
| 19 | Benzo(a)pyrene | 1 | 1 | 3 | | | | |
| 19 | Benzo(b)fluoranthene | 1 | 1 | | | | | |
| 19 | Benzo(g,h,i)perylene | 1 | 2 | | | | | |
| 19 | Benzo(k)fluoranthene | 1 | 3 | | | | | |
| 19 | Benzobutylphthalate | | 1 | | | | | |

NOTE:
1 = Data are of reliable quality
2 = Data are of equivocal quality
3 = Data are of unreliable quality

# Table 3.1
# Potential Candidate Parameters for Limits

| ATG | Parameter | Plant | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Algoma | Dofasco | Hilton | L. Erie | Atlas | IVACO | LASCO |
| 19 | Bis(2-chloroethoxy)methane | | 2 | | | | | |
| 19 | Bis(2-chloroethyl)ether | | 2 | | | | | |
| 19 | Bis(2-chloroisopropyl)ether | | 1 | | | | | |
| 19 | Bis(2-ethylhexyl)phthalate | 3 | 3 | | | | | |
| 19 | Camphene | | 3 | | | | | |
| 19 | Chrysene | 1 | 3 | 2 | | | | |
| 19 | Di-n-butyl Phthalate | | 3 | | | | | |
| 19 | Di-n-octyl Phthalate | | 3 | | | | | |
| 19 | Dibenz(a,h)anthracene | | 2 | | | | | |
| 19 | Diphenylamine | | 3 | | | | | |
| 19 | Fluoranthene | 1 | 3 | 1 | | | | |
| 19 | Fluorene | 1 | 1 | | | | | |
| 19 | Indeno(1,2,3-cd)pyrene | 1 | 2 | | | | | |
| 19 | Indole | | 1 | | | | | |
| 19 | N-Nitrosodi-n-propylamine | | 2 | | | | | |
| 19 | N-Nitrosodiphenylamine | | 3 | | | | | |
| 19 | Naphthalene | 2 | 1 | | | | | |
| 19 | Perylene | 1 | 2 | | | | | |
| 19 | Phenanthrene | 1 | 3 | 1 | | | 3 | |
| 19 | Pyrene | 1 | 3 | 1 | | | | |
| 23 | Hexachlorobenzene | 3 | | | | | | |
| 23 | Hexachloroethane | | 2 | | | | | |
| 25 | Oil and Grease | 1 | 1 | 1 | 2 | 1 | 1 | 1 |
| 26 | Dehydroabietic Acid | 2 | | | | | | |
| IS1 | Iron | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

NOTE:
1 = Data are of reliable quality
2 = Data are of equivocal quality
3 = Data are of unreliable quality

## Table 3.2
## Candidate Parameters for Limits
## Integrated Steel Mills

| ATG | Parameter | ATG | Parameter |
|---|---|---|---|
| 2 | Cyanide Total | 19 | 2,6-Dinitrotoluene |
| 4a | Ammonia plus Ammonium | 19 | 2-Methylnaphthalene |
| 5a | DOC | 19 | 4-Bromophenyl Phenyl Ether |
| 6 | Total Phosphorus | 19 | 4-Chlorophenyl Phenyl Ether |
| 8 | Total Suspended Solids | 19 | Acenaphthylene |
| 8 | Volatile Suspended Solids | 19 | Anthracene |
| 9 | Aluminum | 19 | Benzo(a)anthracene |
| 9 | Cadmium | 19 | Benzo(a)pyrene |
| 9 | Chromium | 19 | Benzo(b)fluoranthene |
| 9 | Lead | 19 | Benzo(g,h,i)perylene |
| 9 | Vanadium | 19 | Benzo(k)fluoranthene |
| 9 | Zinc | 19 | Benzobutylphthalate |
| 10 | Selenium | 19 | Bis(2-chloroisopropyl)ether |
| 12 | Mercury | 19 | Chrysene |
| 14 | Phenolics (4AAP) | 19 | Fluorene |
| 16 | Bromoform | 19 | Fluoranthene |
| 16 | Dibromochloromethane | 19 | Indeno(1,2,3-cd)pyrene |
| 17 | Benzene | 19 | Indole |
| 17 | Styrene | 19 | Naphthalene |
| 17 | Toluene | 19 | Perylene |
| 17 | m-Xylene and p-Xylene | 19 | Phenanthrene |
| 17 | o-Xylene | 19 | Pyrene |
| 19 | 1-Methylnaphthalene | 25 | Oil and Grease |
| 19 | 2,4-Dinitrotoluene | IS1 | Iron |

# Table 3.3
# Candidate Parameter for Limits Mini and Specialty Steel Mills

| Mini Steel Mills | | Specialty Steel Mill | |
|---|---|---|---|
| **ATG** | **Parameter** | **ATG** | **Parameter** |
| 5a | DOC | 5a | DOC |
| 6 | Total Phosphorus | 8 | Total Suspended Solids |
| 8 | Total Suspended Solids | 8 | Volatile Suspended Solids |
| 8 | Volatile Suspended Solids | 9 | Aluminum |
| 9 | Aluminum | 9 | Cadmium |
| 9 | Copper | 9 | Chromium |
| 9 | Lead | 9 | Cobalt |
| 9 | Zinc | 9 | Copper |
| 16 | Chloroform | 9 | Molybdenum |
| 25 | Oil and Grease | 9 | Nickel |
| IS1 | Iron | 9 | Vanadium |
| | | 9 | Zinc |
| | | 11 | Chromium (hexavalent) |
| | | 25 | Oil and Grease |
| | | IS1 | Iron |

## Table 3.4
## Candidate Parameters that Require Further Evaluation

| **Integrated Steel Mills** | | **Mini Steel Mills** | |
|---|---|---|---|
| **ATG** | **Parameter** | **ATG** | **Parameter** |
| 4a | Total Kjeldahl Nitrogen | 4a | Total Kjeldahl Nitrogen |
| 4b | Nitrate plus Nitrite | 4b | Nitrate plus Nitrite |
| 5b | TOC | 5b | TOC |
| 9 | Copper | 9 | Molybdenum |
| 9 | Molybdenum | 11 | Chromium (hexavalent) |
| 9 | Thallium | 16 | Tetrachloroethylene |
| 10 | Arsenic | 16 | Trichloroethylene |
| 11 | Chromium (hexavalent) | 17 | Toluene |
| 15 | Sulphide | **Specialty Steel Mill** | |
| 16 | Chloroform | | |
| 19 | 1-Chloronaphthalene | ATG | Parameter |
| 19 | 2-Chloronaphthalene | | |
| 19 | 5-Nitro, Acenaphtene | 4b | Nitrate plus Nitrite |
| 19 | Acenaphtene | 9 | Antimony |
| 19 | Bis(2-chloroethoxy)methane | 9 | Arsenic |
| 19 | Bis(2-chloroethyl)ether | | |
| 19 | Dibenz(a,h)anthracene | | |
| 19 | N-Nitrosodi-n-propylamine | | |
| 23 | Hexachloroethane | | |
| 26 | Dehydroabietic Acid | | |

## Table 3.5
## Candidate Parameters to be Removed from List

| **Integrated Steel Mills** | | **Mini Steel Mills** | |
|---|---|---|---|
| **ATG** | **Parameter** | **ATG** | **Parameter** |
| 9 | Nickel | 4a | Ammonia plus Ammonium |
| 19 | Bis(2-ethylhexyl)phthalate | 9 | Cadmium |
| 19 | Di-n-butyl Phthalate | 9 | Chromium |
| 19 | Di-n-octyl Phthalate | 9 | Nickel |
| 19 | Diphenylamine | 16 | Methylene Chloride |
| 19 | N-Nitrosodidiphenylamine | 19 | Phenanthrene |
| 23 | Hexachlorobenzene | **Specialty Steel Mill** | |
| | | | |
| | | ATG | Parameter |
| | | | |
| | | 9 | Lead |

## Table 3.6
## Effluent Characteristics of Ontario Plants Cokemaking Process Subcategory

| **ATG** | **Parameter** | **Algoma Steel** | | **Dofasco Inc.** | | **Stelco Hilton Works** * | | **Stelco Lake Erie Works** * | |
|---|---|---|---|---|---|---|---|---|---|
| | | **mg/L** | **kg/d** | **mg/L** | **kg/d** | **mg/L** | **kg/d** | **mg/L** | **kg/d** |
| 2 | Cyanide Total | 1.08 | 9.2 | 40.9 | 115 | 2.52 | 24.5 | 0.583 | 0.561 |
| 4a | Ammonia | 206 | 1750 | 78.5 | 221 | 12.5 | 121 | 0.432 | 0.415 |
| 8 | TSS | 139 | 1180 | 119 | 336 | 42.8 | 416 | 4.87 | 4.68 |
| 14 | Phenolics(4AAP) | 2.69 | 22.9 | 2.55 | 7.19 | 1.37 | 13.3 | 0.0123 | 0.0118 |
| 17 | Benzene | 0.344 | 2.92 | 0.0355 | 0.100 | 0.202 | 1.96 | 0.0118 | 0.0113 |
| 19 | Benzo(a)pyrene | 0.0235 | 0.200 | 0.0603 | 0.170 | 0.00262 | 0.0255 | 0.0118 | 0.0113 |
| 19 | Naphthalene | 0.0447 | 0.380 | 0.0106 | 0.030 | 0.00262 | 0.0255 | 0.0118 | 0.0113 |
| 25 | Oil & Grease | 3.10 | 26.4 | 1.86 | 5.23 | 8.39 | 81.6 | 2.50 | 2.40 |

* Allocation of loadings for each process is based on the MISA monitoring data.

## Table 3.7
## Effluent Characteristics of Ontario Plants
## Ironmaking Process Subcategory

| ATG | Parameter | Algoma Steel | | Dofasco Inc.* | | Stelco Hilton Works** | | Stelco Lake Erie Works | |
|---|---|---|---|---|---|---|---|---|---|
| | | mg/L | kg/d | mg/L | kg/d | mg/L | kg/d | mg/L | kg/d |
| 2 | Cyanide Total | 1.85 | 88.5 | 0.0801 | 0.831 | 0.437 | 4.17 | 0.581 | 1.67 |
| 4a | Ammonia | 2.55 | 122 | 8.68 | 90.0 | 7.73 | 73.7 | 0.430 | 1.24 |
| 8 | TSS | 33.8 | 1610 | 31.0 | 321 | 26.6 | 254 | 4.85 | 13.9 |
| 9 | Total Lead | 0.148 | 7.07 | 0.030 | 0.311 | 0.100 | 0.957 | 0.0439 | 0.126 |
| 9 | Total Zinc | 0.850 | 40.6 | 0.180 | 1.87 | 0.687 | 6.55 | 0.0884 | 0.254 |
| 14 | Phenolics(4AAP) | 0.0628 | 3.00 | 0.0267 | 0.277 | 0.0699 | 0.667 | 0.0122 | 0.0352 |
| 25 | Oil & Grease | - | - | - | - | 3.99 | 38.0 | - | - |

Note: * The reported loadings reflect the restructuring that took place after MISA monitoring.

Note: ** For Stelco Hilton Works the reported values are for both ironmaking and sintering processes.

## Table 3.8
## Effluent Characteristics of Ontario Plants
## Steelmaking Process Subcategory

| **ATG** | **Parameter** | **Algoma Steel** | | **Dofasco Inc.*** | | **Stelco Hilton Works**** | | **Stelco Lake Erie Works** | |
|---|---|---|---|---|---|---|---|---|---|
| | | **mg/L** | **kg/d** | **mg/L** | **kg/d** | **mg/L** | **kg/d** | **mg/L** | **kg/d** |
| 8 | TSS | 89.6 | 1080 | 54.0 | 2160 | - | - | 4.87 | 25.7 |
| 9 | Total Lead | 0.0312 | 0.374 | 0.047 | 1.88 | - | - | 0.0440 | 0.232 |
| 9 | Total Zinc | 0.0435 | 0.522 | 0.200 | 8.00 | - | - | 0.0888 | 0.468 |

Note:* The reported loadings reflect the closure of #1 Melt Shop during the restructuring that took place after MISA monitoring.

Note:** Stelco Hilton Works Steelmaking process is a dry gas cleaning system.

## Table 3.9
## Effluent Characteristics of Ontario Plants
## Continuous Casting and Hotforming Process Subcategories

| ATG | Parameter | Algoma Steel | | Dofasco Inc.* | | Stelco Hilton Works | | Stelco Lake Erie Works* | |
|---|---|---|---|---|---|---|---|---|---|
| | | mg/L | kg/d | mg/L | kg/d | mg/L | kg/d | mg/L | kg/d |
| 8 | TSS | 2.82 | 795 | 4.8 | 23.6 | 6.46 | 2340 | 4.88 | 51.3 |
| 9 | Total Lead | 0.0156 | 4.39 | 0.0489 | 0.240 | 0.00298 | 1.08 | 0.026 | 0.274 |
| 9 | Total Zinc | 0.0215 | 6.07 | 0.0326 | 0.160 | 0.0335 | 12.1 | 0.053 | 0.522 |
| 25 | Oil & Grease | 1.11 | 314 | 4.5 | 22.1 | 2.02 | 732 | 2.39 | 25.2 |

* For Dofasco Inc. and Stelco Lake Erie Works, the loading given includes loading from the vacuum degassing process.

## Table 3.10
## Effluent Characteristics of Ontario Plants
## Hotforming Operation Mills

| **ATG** | **Parameter** | **Algoma Steel** | | | | **Stelco Hilton Works** | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | **#1 Tube Mill** | | **#2 Tube Mill** | | **#3 B&B** | | **#2 Rod Mill** | |
| | | **mg/L** | **kg/d** | **mg/L** | **kg/d** | **mg/L** | **kg/d** | **mg/L** | **kg/d** |
| 8 | TSS | 9.32 | 14.2 | 3.37 | 2.96 | 10.9 | 403 | 5.69 | 154 |
| 25 | Oil & Grease | 1.46 | 2.24 | 1.83 | 1.61 | 1.62 | 59.9 | 1.36 | 36.8 |

## Table 3.11
## Effluent Characteristics of Ontario Plants
## Finishing Operation *

| **ATG** | **Parameter** | **Stelco Hilton Works** | |
|---|---|---|---|
| | | **mg/L** | **kg/d** |
| 8 | TSS | 6.26 | 379 |
| 9 | Total Lead | 0.0235 | 1.42 |
| 9 | Total Zinc | 0.178 | 10.8 |
| 9 | Total Chromium | 0.0195 | 1.18 |
| 25 | Oil and Grease | 1.99 | 120 |

* Stelco Hilton Works' finishing operation includes acid pickling, cold rolling, alkaline cleaning, hot coating and electrolytic tinning.

## Table 3.12
## Effluent Characteristics of Ontario Plants
## Mini-Mills and Specialty Steel Mill

| ATG | Parameter | Atlas Specialty Steels | | Lake Ontario Steel Company (LASCO) | |
|---|---|---|---|---|---|
| | | mg/L | kg/d | mg/L | kg/d |
| 8 | TSS | 4.06 | 57.9 | 9.75 | 66.0 |
| 9 | Total Chromium | 0.0212 | 0.303 | - | - |
| 9 | Total Nickel | 0.128 | 1.83 | - | - |
| 9 | Total Lead | - | - | 0.0517 | 0.350 |
| 9 | Total Zinc | 0.0899 | 1.28 | 0.355 | 2.40 |
| 25 | Oil and Grease | 1.69 | 24.1 | 2.22 | 15.0 |

# Chapter 4
# Best Available Technology

## 4.1 Model BAT Options

This chapter describes the significant findings of the study[11] that was conducted by Hatch Associates Ltd, an engineering consultant retained by the Ministry, to:

- develop an inventory of the best available technology which could be used for water pollution control in Ontario iron and Steel plants.
- develop approximate capital and operating costs to retrofit BAT systems in Ontario mills.

The Ministry supplied the Consultant with the following documents:

- the 12-month monitoring data for each plant including long term average concentration and loading data for all contaminants that were monitored for each plant.
- information on manufacturing processes, water usage, and existing effluent treatment systems.
- Environment Canada Wastewater Technology Centre reports on the wastewater treatment performance evaluation[5] of several processes in the sector plants and the filtration study of iron and steel effluent[4].

## 4.2 Selection of Parameters for BAT Evaluation

The Parameter Selection List, which was formulated after the QA/QC screening, was further evaluated to assess the treatability of each parameter in each process subcategory.

The criteria used for the selection of the parameters to be assessed in this study were as follows:

- Treatment performance data was readily available in the iron and steel sector;
- The pollutant was known to be treatable with proven technology;

- The pollutant was known to be generated within a process;
- The pollutant was representative of a class of pollutants or the pollutant was indicative of the overall treatment effectiveness of a process.

As shown in Table 4.1 each parameter was classified as follows:

1 = No Performance Data Available (in the iron and steel sector)
2 = Performance Data Available

Out of the thirty two parameters that were classified as "treatable", twelve parameters with demonstrated performance values within the particular sub-sector or subcategory were used to evaluate a variety of models for the Best Available Technology. The twelve parameters consisted of two conventionals (total suspended solids and oil & grease), three non-conventionals (total cyanide, ammonia and phenolics) and seven toxic pollutants (chromium, lead, zinc, nickel, benzene, benzo(a)pyrene and naphthalene).

## 4.3 Selection and Description of BAT Models

Five Best Available Technology (BAT's) models were developed for the various categories in the Iron and Steel Sector in Ontario. These five BAT models were:

| | |
|---|---|
| BAT #1 | Best in Ontario |
| BAT #2 | Best in the USA |
| BAT #3 | Best at Selected World Locations |
| BAT #4 | Non-Lethal (passes Ontario Toxicity Test) |
| BAT #5 | Virtual Elimination of Persistent Toxic Substances |

The selected world locations were Canada, the United States, Germany, Holland, Japan and South Korea.

The following approach was taken to develop BAT's for each of the above models:

| | |
|---|---|
| BAT #1 | evaluation of MISA monitoring data to determine the best performing mills in Ontario; |
| BAT #2 | identification of the best mills in the United States that are similar to or contain the same production processes as the Ontario Mills; |
| BAT #3 | evaluation of wastewater treatment at selected mills in Germany, Holland, Japan, and South Korea and the best |

technologies in the USA and Canada to identify the "best in the world".

BAT #4 evaluation of long term monitoring data for the mill identified as best in the world under BAT 3 to assess whether effluent will be lethal or non-lethal; and whether treatment technologies exist to further reduce contaminant levels to make effluent non-lethal.

BAT #5 evaluation of long term monitoring data for the BAT #3 mill to assess whether virtual elimination of persistent toxic substances had been achieved, or to assess further treatment to achieve virtual elimination.

The performance of BAT plants was evaluated in terms of production-based loadings to take into account plants with different production rates (i.e sizes). The BAT plants are characterized by the lowest production-based loadings. Emphasis was focused on plants with low flows where efficient use of process water through in-plant recycle and reuse is practised together with well operated end-of-pipe treatment facilities.

A comparison of water usage at each process subcategory in Ontario and USA plants is illustrated in Table 4.2.

Best Available Technology plants in the world were selected either from Ontario or USA since there were little or no performance data available from the overseas plants and since the consultant did not observe technology better than that in North America. The BAT model in the world was therefore selected either from Ontario or USA.

The following is a description of the technology train for each process subcategory demonstrated as best in Ontario or the United States:

**Cokemaking:**

The technology train demonstrated at the Stelco Lake Erie Works which is found to be the best in the world, consists of equalization, ammonia stills, further equalization, pH adjustment, biological oxidation, alkaline breakpoint chlorination followed by filtration and dechlorination. This technology train treats a flow of 0.6 $m^3$/tonne of coke produced.

The technology train used through out the United States is similar to that of the Stelco Lake Erie Works but without the alkaline breakpoint chlorination and filtration..The best two plants in the USA were Clairton (process flow 0.863 $m^3$/tonne of coke) and Inland Steel (flow 0.54 $m^3$/tonne). The cokemaking operations at Inland Steel has a limited by-product recovery since the crude light oil is not removed from the coke oven gas and the recovered ammonia from the ammonia stills is incinerated.

**Sintering:**

The technology train demonstrated at Bethlehem Steel at Sparrow's Point, which is selected as the best in the world, consists of pH adjustment, chemically assisted metals removal followed by clarification of 90% recirculated process water followed by filtration of a blowdown of 0.46 $m^3$/tonne of sinter produced.

**Ironmaking:**

The technology train demonstrated at the Stelco Lake Erie Works, which is selected as the best in the World, consists of clarification, 96% recycle of process water, chemically assisted metals removal for a blowdown of 0.8 $m^3$/tonne of molten iron produced followed by alkaline breakpoint chlorination, filtration and dechlorination.

High rate recycle of blast furnace gas wash waters is practised at the United States plants. The blowdown is not generally treated since the applicable effluent limits can be achieved with the high rate recycle and disposal of the blowdown on slag pits for quenching. The Ministry has rejected this concept due to the concerns related to air emissions and potential contamination from leachate of the slag used in road construction.

The technology train which does not include the disposal of untreated blowdown on the slag and produces the lowest loading, with the exception of ammonia-N, is demonstrated at Bethlehem Steel, Sparrow's Point. It is similar to that of the Stelco Lake Erie Works but without the alkaline breakpoint chlorination and filtration. The recycle rate however is 98% which results in a blowdown of 0.26 $m^3$/tonne of molten iron.

It should be pointed out that the Iron and Steel Industry in the United States are allowed to request a variance under the U.S. Clean water Act where a deviation from the U.S.EPA effluent guidelines is granted. The US BAT plants have been granted variances for ammonia discharges from the ironmaking process subcategory thus eliminating the need for alkaline breakpoint chlorination which was part of the U.S.EPA BAT treatment system.

The variance is based on the principle of "Fundamentally Different Factor" which may include the following:

1. The age of the equipment and facilities
2. Energy requirements of the application of control and treatment technology
3. Process changes
4. Others, as the U.S.EPA Administrator deems appropriate

**Steelmaking:**

The technology trains demonstrated at LTV Steel, Cleveland for suppressed combustion and at Inland Steel Indiana Harbour Works, Indiana for open combustion are considered to be the best in the World. The technology trains consist of clarification, recycle of process water with a blowdown of 0.002 $m^3$/tonne of molten steel produced from the suppressed combustion process and a blowdown of 0.24 $m^3$/tonne of molten steel produced from the open combustion process. The blowdown from both of these processes are treated by chemically assisted metals removal followed by clarification and filtration.

The technology train at the Stelco Lake Erie Works is identified as the best in Ontario. It is similar to that used in the United States but with a blowdown rate of 1.1 $m^3$/tonne of molten steel.

**Vacuum Degassing:**

The technology train demonstrated at the Stelco Lake Erie Works is considered as the best in the world. It consists of clarification, 98% recirculation of process water resulting in a blowdown of 0.11 $m^3$/tonne of steel. The blowdown is treated by chemically assisted metals removal followed by clarification and filtration.

The Vacuum Oxygen Refining System (VORS) at Atlas Specialty Steels is a unique process which consists of two processes: a vacuum degassing unit and an oxygen blowing decarburization unit. The vacuum degassing unit is similar to the Stelco Lake Erie Works and has a water use of 0.07 $m^3$/tonne of steel. The oxygen decarburization unit produces large volume of dust and metal oxides which are captured within the vacuum system and scrubbed and discharged to the water treatment system. The blowdown for this process is 1.33 $m^3$/tonne of steel.

**Continuous Casting:**

The technology train demonstrated at Inland Steel, Indiana Harbour Works, Indiana is considered to be the best in the world. It consists of a scale pit with oil skimming followed by filtration and a high rate (99%) of recycle of process water. A blowdown of 0.076 $m^3$/tonne is treated through chemically assisted metals removal followed by clarification and filtration.

Both Dofasco and Stelco Lake Erie Works employ modern recycle systems for caster contact cooling water. Stelco Lake Erie Works is selected as BAT #1 since effluent quality data are available and the filter back wash (which is the system blowdown) is treated together with the process water in the Blowdown Treatment Plant.

Dofasco's No. 2 Hot Mill Filter Plant is similar to the Stelco LEW system with respect to contaminants discharged, but no sufficient data are available. In addition, the filter back wash is partly treated in the steelmaking clarifier.

The Stelco LEW technology train is similar to that used in the Indiana Harbour Works but it treats a blowdown of 1.4 $m^3$/tonne. This flow represents the process flow as well as a blowdown from the recycled cooling water.

**Hot Forming:**

The technology train demonstrated at the USS Gary Works, Indiana is considered to be the best in the world. The process water flows to scale pits for the removal of heavy solids and oil. The process water is then filtered and recycled and the blowdown of 0.36 $m^3$/tonne is treated through chemically assisted solids removal followed by clarification and filtration.

The wastewater treatment technology demonstrated at the Stelco Lake Erie Works and Dofasco is considered as the best technology in Ontario. The technology train is similar to that used in the USS Gary Works but it treats a blowdown of 0.85 $m^3$/tonne.

**Finishing:**

The finishing operations consists of acid pickling, cold forming, alkaline cleaning, hot coating and electrolytic plating. The waste streams from each process are pre-treated prior to a central treatment. The oily wastewater is treated in a flow equalization tank followed by oil separators. The oil is further separated in a dissolved air flotation. Chrome wastewaters are treated through ion exchange. Final combined treatment of alkaline and acidic rinsewaters as well as scrubber waters (from acid regeneration plants) are treated through chemically assisted metals removal followed by clarification and filtration.

Unlike the U.S.EPA approach, pickling production is selected as the base production rate to normalize effluent loadings. Although the production mix at each finishing plant is different, all steel processed must be pickled. Ratios of production of finishing operations to pickled production indicated a reasonably good agreement for the hot coating and electroplating operations where the highest usage of toxic metals occurs.

The technology trains demonstrated in Ontario (Stelco Hilton Works and Dofasco) and the United States (National Steel's Midwest Division, Portage, Indiana) were similar and considered as the best in the world. Dofasco's finishing operations have the components of BAT, but performance data were not available since wastewaters from the operations were discharged to the Hamilton STP.

## 4.4 Ministry and Industry Review

In order to review the Best Available Technology performance data for each process subcategory, an Effluent Limit Setting Subcommittee (ELSS) was formed under the Iron and Steel Sector Joint Technical Committee. The subcommittee consisted of representatives from the Industry, Environment Canada and the Ontario Ministry of the Environment. The subcommittee conducted a detailed review of the BAT consultant report, the BAT performance data and the existing Certificates of Approval and Control Orders.

The subcommittee's recommendations were considered in the development of effluent loading limits.

During the deliberations of the Subcommittee the following concerns were addressed:

**Cokemaking operation:**

The flow factor selected to limit discharges from the cokemaking operations at Algoma Steel, Dofasco and the Stelco Hilton Works was 0.79 $m^3$/tonne. This flow which represents the average of the Stelco Lake Erie Works flow (BAT#1) (0.6 $m^3$/tonne) and the flow used by the U.S.EPA (0.98 $m^3$/tonne), allows for additional flows from such processes as wet desulphurizers and dilution water which may be required to optimize biological oxidation. The selected flow factor does not provide for allowances due to treatment of ground water. The Ministry will not increase the flow factor for the cokemaking operations unless the industry demonstrates the need for additional flows to treat ground water in the area of the cokemaking operations.

The technology train that was recommended by the ELSS consisted of equalization, ammonia stills, pH adjustment followed by biological oxidation, clarification and filtration.

The concentration performance for ammonia, cyanide and phenolics, as shown in Table 4.3, was based on the average concentration of the U.S.EPA effluent guidelines, USS Clairton and Inland Steel, Indiana Harbour.

The performance concentration for TSS was based on a long term average of 9.8 mg/L as a result of the polishing filtration step in the technology train[4]. This concentration represented a more stringent performance than that adopted by the U.S.EPA.

**Sintering/Ironmaking operations:**

The technology train that was recommended by the ELSS consisted of recirculation of the blast furnace scrubber water systems, followed by improving chemically assisted metals removal and filtration.

Because of the concern that was raised by the sector regarding the use and handling of chlorine as part of the alkaline breakpoint chlorination, to destroy cyanide, ammonia and phenolics in the ironmaking process effluent, at the old integrated plants (Dofasco, Algoma and Stelco Hilton Works), this treatment step was not included in the technology train for the ironmaking process.

The Stelco Hilton Works is the only plant in Ontario which has sintering operations. At the Hilton Works, the blast furnace scrubber water is recirculated with a blowdown of 1.71 $m^3$/tonne which is then directed to the sinter plant's exhaust wet scrubber to clean the sinter plant gases. The process water is then discharged to the ESFP for final treatment.

The ELSS decided that effluent limits for the combined operation of the sintering and ironmaking at the Stelco Hilton Works should be based on the Stelco's system since any further flow reductions may require Stelco to dismantle and completely rebuild their system. A complete rebuild would disrupt production activities with a potential reduction in production and reduced revenues.

The committee also agreed that since Dofasco and Algoma have no sintering operations, the flow for their ironmaking operations could represent the average of the Stelco flow (1.71 $m^3$/tonne) and the current Dofasco's ironmaking process flow of 0.214 $m^3$/tonne. The Dofasco's blast furnace washing water recirculating system which was installed in 1990, following the MISA monitoring period, did not include flows from other processes, such as the dekish station, de-sulphurization, blast furnace floc tank and trench spray water, which are all related to the ironmaking operations. The average flow factor of 0.962 $m^3$/tonne should allow Dofasco to include these additional flows in the treatment of the ironmaking process water. The average flow factor of 0.962 $m^3$/tonne represents a significant reduction in the process flow of Algoma steel's ironmaking as its current flow rate is 8 $m^3$/tonne.

The post-MISA performance of the ironmaking treatment systems at the Stelco Hilton Works and Dofasco and the average performance of the two systems are shown in Table 4.4.

**Steelmaking Subcategory:**

Industry representatives of the ELSS expressed concern regarding the technology train that was used by LTV at Cleveland, that was also selected as the best in the world. They pointed out that the $CO_2$ injection technology for the steelmaking was dependent on many site specific factors and that it could not be easily transferable. As a result, the performance of the technology cannot be precisely predicted. This technology however, should be viewed as a candidate for consideration in future process modifications or pollution reduction initiatives.

The subcommittee agreed to use the technology train for BAT#1 (i.e. Stelco lake Erie Works) which consisted of recirculation followed by chemically assisted metals removal and filtration.

**Vacuum Degassing:**

The ELSS recommended the use of BAT#1 as the basis for limits for this process subcategory in the integrated steel plants. The subcommittee also agreed to use the existing performance of the Vacuum Oxygen Decarburization System at Atlas Specialty Steels since it is a unique process.

**Continuous Casting and Hot Forming:**

The BAT consultants indicated that in order to introduce recycle systems for the process waters from the continuous casting and hot forming, especially at Algoma Steel and the Stelco Hilton Works, an extensive retrofit would be required to separate the process water from the plant water supply and cooling water systems. As a result, a substantial increase in the energy consumption would occur.

The existing technology train for the continuous casting and hotforming at the Ontario plants has the components of best available technology but with no or minimal water use conservation. The components of the train are settling basins equipped with surface skimming to remove oil and grease, followed by clarification and filtration. The ELSS agreed that the existing performance of the continuous casting and hotforming operations at each integrated steel plant will be used in setting effluent limits for these process subcategories. In addition, these operations do not generate persistent toxic pollutants.

## 4.5 Performance Data for BAT Models

The performance of BAT technology for each process subcategory is expressed as long term average production-based loading.

Since the Stelco Lake Erie Works (BAT#1) has a central treatment facility, it was necessary to allocate a portion of the total loading, measured during MISA monitoring period, to each process subcategory. This allocation was necessary to generate performance data for the central treatment train that could be attributed to each process subcategory.

A flow proportional allocation approach, based on the flow ratios shown in Table 4.5, was used. This approach has resulted in loadings representative of a stand alone technology train performance for each process and facilitated comparison among the BAT treatment trains.

Table 4.6 outlines the performance data in terms of production-based loadings of each process subcategory for the model BAT plants in Ontario and the U.S. and the technology train that was recommended by the Effluent Limits Setting Subcommittee.
The performance of the technology train that was used by the U.S.EPA to define the process subcategory based limits are also shown for comparison purposes. Appendix III provides a summary of the approach for the selection of the technology train used by the U.S.EPA.

## 4.6 Technology Train Costs and Attainable Loadings

Based on the best available technology train for each process subcategory found in Ontario and the U.S., as well as the technology train recommended by the ELSS, the following four options were developed and applied to the integrated steel plants:

Option #1 BAT in Ontario applied to each process subcategory
Option #2 BAT in U.S. applied to each process subcategory
Option #3 BAT in the world (combination of best technology found in Ontario and U.S.) applied to those processes that were the major sources of persistent toxic substances

Option #4 BAT recommended by the ELSS applied to those processes that were the major sources of persistent toxic substances.

For the mini-mills and specialty steel mill, three options were developed:

Option #1 BAT in Ontario applied to each process subcategory
Option #2 BAT in U.S. applied to each process subcategory
Option #3 BAT recommended by the ELSS applied to each process subcategory. This option corresponds to Option #4 for the integrated steel plants.

There was no BAT option 1 defined for Atlas Specialty Steels since this plant is the only specialty steels facility in Ontario.

Ivaco was not selected as BAT option #1 for the mini-mills, although it had a closed loop system during the MISA monitoring phase. Ivaco found it difficult to maintain that mode of operation on continuous basis. BAT option #1 for the mini-mills was developed on the basis of a process flow, of up to 1 $m^3$/tonne of steel, discharged from a recycle system and treated through clarification and filtration facilities.

Effluent loadings that are predicted through the application of BAT models and the ELSS option to each Iron and Steel Plant are presented in tables 4.7 to 4.12 along with the capital and operating costs to implement the technology.

The loadings in kg/day were calculated by multiplying the Model BAT production-based loading (g/tonne) by the average production, during the MISA monitoring period, of the specific process subcategory and adding the loadings of each process subcategory to evaluate the total plant process loading. The cost estimates are those costs required to retrofit the selected technology train to permit an Ontario plant to attain a similar performance to that achieved by the BAT plant.

## 4.7 Economic Assessment

The objectives of the economic assessment were to:

- evaluate the cost-effectiveness of the various wastewater treatment BAT options;
- show the incremental cost of successively higher levels of contaminant removal; and

- ascertain the potential economic and financial consequences of those BAT Options that are least-cost.

The analytical techniques that were applied to analyze the costs of potential abatement technology options postulated for each firm, results of cost effectiveness analyses and the financial assessments and effects of BAT option costs on the sector plants are outlined in Appendix IV.

The most cost-effective BAT option for the integrated plants, Algoma, Dofasco and Stelco Hilton Works, was option 4. The unit cost for this option as shown in Table A4.1 in Appendix IV was $2.39/kg of contaminant removed at Algoma, $6.56/kg of contaminant removed at Dofasco and $18.22/kg of contaminant removed at Stelco Hilton Works.

The most cost-effective BAT Options for the non-integrated steel mills, Atlas, Ivaco and Lasco was option 3. The unit cost of this option as shown in Table A4.2 in Appendix IV was $4.85/kg of contaminant removed at Atlas Specialty Steels and $6.81/kg of contaminant removed at Lasco.

In the case of Ivaco, "BAT Option 3" was postulated as a fail-safe option since no process effluent was discharged during the MISA monitoring phase and the firm found it difficult to maintain that level of performance on a continuous basis.

The total annualized cost for compliance with the recommended option was estimated at $18.8 million/year after-tax over ten years, based on a total capital cost of $118.5 million and, operating and maintenance (O&M) costs of $11.3 million/year (Table 4.13).

This level of compliance costs would only marginally worsen the financial position of all three steel mills. However, with the exception of Stelco, the declines in net income/profit would be similar to income declines that these firms have already experienced during more sanguine period prior to the 1989 - 1991 recession.

Furthermore, when after-MISA costs "Return on Capital," a key indicator of financial performance, was compared with the before-MISA 1983-1992 average (baseline) performance and, the 1992 performance, the changes due potential MISA expenditures for each of the three integrated steel mills were marginal, ranging between -0.3% and -0.7%. In addition, when the three mills' projected 1994 profit performance were compared with their "after-tax" annualized MISA compliance costs, the estimated compliance costs would account for 4.8%, 3.9% and 21.5% of the 1994 profits of Algoma, Dofasco and Stelco Inc., respectively.

The effects of the estimated MISA costs on several financial indices calculated for the non-integrated mills were minimal, ranging from 0% to 0.1%. Furthermore, these mini mills constitute the only segment of the iron and steel sector to have returned a profit in each of the last three years.

Ontario's iron and steel industry returned to profitability in 1994 with all three integrated steel mills making a profit following the recession. Higher product prices and strong demand from the buoyant automotive industry are identified as reasons for the improved performance.

Algoma and Dofasco continue to out perform other Canadian integrated steel mills, including Stelco Inc. For the first six months of 1994, Algoma returned a profit of $49 million on sales of $528 million compared to a loss of $22.3 million for the same period in 1993. Dofasco realized a profit of $103.7 million on sales of $1.1 billion, compared to a loss of $5.8 million over the corresponding period in 1993. Stelco Inc., Canada's largest steel maker, returned a profit of $13 million on sales of $1.4 billion, compared to a loss of $51 million it incurred on sales of $1.2 billion for the same period in 1993.

The estimated compliance costs for the recommended effluent limits would be less burdensome on the sector firms now, than at any period in the previous three years. Furthermore, growth in product demand would provide sector firms the required funds to further invest in facilities and products upgrading, investments needed if Ontario steel mills are to remain competitive. MISA-induced expenditures would coincide with this cycle of infrastructure investments. At the height of the recession between 1989 and 1993, Canada's iron and steel industry invested $2 billion in facilities' upgrades.

Iron and steel is a cyclical industry that is currently experiencing an upswing in demand. In 1993, shipments in iron and steel increased by an annual rate of 9% this level of growth is expected to continue over the next two years, and perhaps, beyond.

## Table 4.1
## Selection of Parameters for BAT Evaluation

| ATG | Parameter | Performance Data Availability | Parameter Selection | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | Integrated Mills | | | | | Specialty Mills | Mini-Mills |
| | | | Coke | BF & Sinter | BOF & C.C. | Hotform | Finish | | |
| 2 | Cyanide Total | 2 | X | X | | | | | |
| 4a | Ammonia + Ammonium | 2 | X | X | | | | | |
| 5a | Dissolved Organic Carbon | 1 | | | | | | | |
| 6 | Total Phosphorus | 1 | | | | | | | |
| 8 | Total Suspended Solids | 2 | X | X | X | X | X | X | X |
| 8 | Volatile Suspended Solids | 1 | | | | | | | |
| 9 | Aluminum | 1 | | | | | | | |
| 9 | Cadmium | 1 | | | | | | | |
| 9 | Chromium | 2 | | | | | X | X | |
| 9 | Cobalt | 1 | | | | | | | |
| 9 | Copper | 1 | | | | | | | |
| 9 | Lead | 2 | | X | X | | X | X | X |
| 9 | Molybdenum | 1 | | | | | | | |

NOTE: 1 = No Performance Data Available 2 = Performance Data Available
X = Parameter Selected for BAT Evaluation

## Table 4.1
## Selection of Parameters for BAT Evaluation

| ATG | Parameter | Performance Data Availability | Parameter Selection | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | Integrated Mills | | | | | Specialty Mills | Mini-Mills |
| | | | Coke | BF & Sinter | BOF & C.C. | Hotform | Finish | | |
| 9 | Nickel | 2 | | | | | | X | |
| 9 | Vanadium | 1 | | | | | | | |
| 9 | Zinc | 2 | | X | X | | X | X | X |
| 10 | Selenium | 1 | | | | | | | |
| 11 | Chromium (hexavalent) | 1 | | | | | | | |
| 12 | Mercury | 1 | | | | | | | |
| 14 | Phenolics (4AAP) | 2 | X | X | | | | | |
| 16 | Bromoform | 1 | | | | | | | |
| 16 | Chloroform | 1 | | | | | | | |
| 16 | Dibromochlormethane | 1 | | | | | | | |
| 17 | Benzene | 2 | X | | | | | | |
| 17 | Styrene | 1 | | | | | | | |
| 17 | Toluene | 1 | | | | | | | |
| 17 | m-Xylene and p-Xylene | 1 | | | | | | | |
| 17 | o-Xylene | 1 | | | | | | | |

NOTE: 1 = No Performance Data Available 2 = Performance Data Available
X = Parameter Selected for BAT Evaluation

## Table 4.1
## Selection of Parameters for BAT Evaluation

| ATG | Parameter | Performance Data Availability | Parameter Selection | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | Integrated Mills | | | | | Specialty Mills | Mini-Mills |
| | | | Coke | BF & Sinter | BOF & C.C. | Hotform | Finish | | |
| 19 | 1-Methylnaphthalene | 1 | | | | | | | |
| 19 | 2,4-Dinitrotoluene | 1 | | | | | | | |
| 19 | 2,6-Dinitrotoluene | 1 | | | | | | | |
| 19 | 2-Methylnaphthalene | 1 | | | | | | | |
| 19 | 4-Bromophenyl Phenyl Ether | 1 | | | | | | | |
| 19 | 4-Chlorophenyl Phenyl Ether | 1 | | | | | | | |
| 19 | Acenaphthylene | 1 | | | | | | | |
| 19 | Anthracene | 1 | | | | | | | |
| 19 | Benz(a)anthracene | 1 | | | | | | | |
| 19 | Benzo(a)pyrene | 2 | X | | | | | | |
| 19 | Benzo(b)fluoranthene | 1 | | | | | | | |
| 19 | Benzo(g,h,i)perylene | 1 | | | | | | | |
| 19 | Benzo(g,h,i)perylene | 1 | | | | | | | |
| 19 | Benzo(k)fluoranthene | 1 | | | | | | | |

NOTE: 1 = No Performance Data Available     2 = Performance Data Available
X = Parameter Selected for BAT Evaluation

## Table 4.1
## Selection of Parameters for BAT Evaluation

| ATG | Parameter | Performance Data Availability | Parameter Selection | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | Integrated Mills | | | | | Specialty Mills | Mini-Mills |
| | | | Coke | BF & Sinter | BOF & C.C. | Hotform | Finish | | |
| 19 | Benzobutylphthalate | 1 | | | | | | | |
| 19 | Bis(2-chloroisopropyl)ether | 1 | | | | | | | |
| 19 | Chrysene | 1 | | | | | | | |
| 19 | Fluorene | 1 | | | | | | | |
| 19 | Fluoranthene | 1 | | | | | | | |
| 19 | Indeno(1,2,3-cd)pyrene | 1 | | | | | | | |
| 19 | Indole | 1 | | | | | | | |
| 19 | Naphthalene | 2 | X | | | | | | |
| 19 | Perylene | 1 | | | | | | | |
| 19 | Phenanthrene | 1 | | | | | | | |
| 19 | Pyrene | 1 | | | | | | | |
| 25 | Oil and Grease | 2 | X | X | X | X | X | X | X |
| IS1 | Iron | 1 | | | | | | | |

NOTE: 1 = No Performance Data Available 2 = Performance Data Available
X = Parameter Selected for BAT Evaluation

# Table 4.2
# Comparison of Typical Process Water Consumption Rates at Various Ontario and USA Plants

| Plant | Location | Consumption ($m^3$/tonne) | Remarks |
|---|---|---|---|
| **Cokemaking** | | | |
| U.S.EPA BAT$^{\text{Note 1}}$ | | 0.64 | Incl. 0.208 $m^3$/t dilution water |
| Inland Steel Corp. | Indiana | 0.54 | No NH3 or light oil recovery |
| Stelco Lake Erie Works | Ontario | 0.60 | |
| Dofasco Inc. | Ontario | 0.71 | |
| USS Clairton Works | Pennsylvania | 0.86 | Incl. 0.28 $m^3$/t dilution allowance |
| Stelco Hilton Works | Ontario | 1.8 | Coke Side Shed emissions only |
| Algoma Steel | Ontario | 2.9 | Not incl. Coke Quench Wastewater |
| **Sintering (Wet)** | | | |
| U.S.EPA BAT | | 0.50 | |
| USS Gary Works | Indiana | 0.0091 | Slag quench |
| Bethlehem Steel - SP* | Indiana | 0.46 | |
| Stelco Hilton Works | Ontario | 7.55 | |
| **Blast Furnaces** | | | |
| U.S.EPA BAT | | 0.29 | |
| Inland Steel No. 7 | Indiana | 0 | Slag quench |
| USS Gary Works | Indiana | 0.015 | Slag quench |
| USS/KOBE Steel | Ohio | 0.031 | Slag quench |
| LTV Steel Cleveland | Ohio | 0.042 | Slag quench |
| Wheeling-Pittsburgh - MJ* | Ohio | 0.079 | |
| Bethlehem Steel - BH* | Indiana | 0.092 | Slag quench |
| Dofasco Inc. | Ontario | 0.214 | Note 3 |
| Wheeling-Pittsburgh - S* | Ohio | 0.19 | |
| Bethlehem Steel - SP* | Indiana | 0.26 | |
| Stelco Lake Erie Works | Ontario | 0.79 | Slag quench 0.08 $m^3$/tonne excl. |
| Stelco Hilton Works | Ontario | 1.71 | |
| Algoma Steel | Ontario | 8.2 | |

## Table 4.2
## Comparison of Typical Process Water Consumption Rates at Various Ontario and USA Plants

| Plant | Location | Consumption ($m^3$/tonne) | Remarks |
|---|---|---|---|
| **Steelmaking - BOF (wet)** | | | |
| U.S.EPA BAT | | 0.21 | Wet suppressed combustion |
| Stelco Hilton Works | Ontario | 0 | Dry Gas Cleaning |
| LTV Steel Cleveland | Ohio | <0.002 | Intermittent discharge |
| USS/KOBE Steel | Ohio | 0.058 | |
| Bethlehem Steel-BH* | Indiana | 0.075 | |
| Inland Steel No. 4 | Indiana | 0.24 | |
| Wheeling-Pittsburgh - MJ* | Ohio | 0.57 | |
| Stelco Lake Erie Works | Ontario | 1.1 | |
| Algoma Steel | Ontario | 1.88 | |
| Dofasco Inc. | Ontario | 7.5 | |
| **Continuous Casters** | | | |
| U.S.EPA BAT | | 0.10 | |
| USS Gary Works No. 2 | Indiana | <0.037 | Slab |
| Inland Steel No. 2 | Indiana | 0.075 | Slab |
| Inland Steel No. 1 | Indiana | 0.083 | Slab |
| Bethlehem Steel- BH* No.1 | Indiana | 0.10 | Slab |
| USS/KOBE Steel | Ohio | 0.11 | Slab |
| Dofasco Inc. | Ontario | 0.837 | Slab. Includes hotforming and vacuum degassing |
| Stelco Lake Erie Works | Ontario | 1.36 | Slab - Includes machine cooling water |
| Stelco Hilton Works | Ontario | 5.99 | |
| Algoma Steel - #1 CC | Ontario | 38.6 | |
| Algoma Steel - #2 CC | Ontario | 19.3 | Includes hotforming |

# Table 4.2
# Comparison of Typical Process Water Consumption Rates at Various Ontario and USA Plants

| Plant | Location | Consumption ($m^3$/tonne) | Remarks |
|---|---|---|---|
| **Hot Forming** | | | |
| U.S.EPA BPT Note 2 | | 2.5 - 11 | 65% recycle of applied flows |
| US NSPS Note 2 | | 0.25 - 1.1 | 96% recycle of applied flows |
| LTV Steel Cleveland | Ohio | 0.29 | Hot Strip |
| USS Gary Works | Indiana | 0.36 | Hot Strip |
| Stelco Lake Erie Works | Ontario | 0.85 | Hot Strip |
| Dofasco Inc. No. 2 Hot Mill | Ontario | 0.837 | Hot Strip - Includes continuous casting and vacuum degassing |
| Dofasco Inc. No. 1 Hot Mill | Ontario | 17 | Closed as of November 1993 |
| Stelco Hilton Works No.2 Rod Mill | Ontario | 22 | |
| Stelco Hilton Works | Ontario | 31.7 | |
| Stelco Hilton Works #3 Bloom & Billet | Ontario | 22.6 | |
| Algoma Steel No.1 Tube Mill | Ontario | 29 | |
| Algoma Steel No.2 Tube Mill | Ontario | 4.4 | Pipe and Tube |
| Algoma Steel | Ontario | 19.3 | Includes #2 CC |

Note: * Bethlehem Steel - SP = Bethlehem Steel - Sparrows Point
Bethlehem Steel - BH = Bethlehem Steel - Burns Harbour
Wheeling-Pittsburgh - MJ = Wheeling-Pittsburgh - Mingo Junction
Wheeling-Pittsburgh - S = Wheeling-Pittsburgh - Steubenville

Note 1: Does not include 0.104 $m^3$/tonne for qualified desulfurizer and 0.250 $m^3$/tonne for indirect ammonia recovery

Note 2: Depends on the type of hotforming process

Note 3: Excludes de-sulfurization, dekish station, blast furnace floc tank, and trench spray water.

## Table 4.3
## ELSS Performance for the Cokemaking Process Subcategory (mg/L)

| ATG | Parameter | U.S.EPA | USS Clairton | Inland Steel | ELSS |
|---|---|---|---|---|---|
| 2 | Cyanide Total | 2.73 | 4.19 | 6.94 | 4.63 |
| 4a | Ammonia + Ammonium | 6.98 | 3.78 | 1.68 | 4.15 |
| 14 | Phenolics (4AAP) | 0.0209 | 0.050 | 0.0390 | 0.0367 |

## Table 4.4
## ELSS Performance for the Ironmaking Process Subcategory (g/tonne)

| ATG | Parameter | Dofasco | Stelco Hilton Works | ELSS* |
|---|---|---|---|---|
| 2 | Cyanide Total | 0.020 | 0.0806 | 0.0503 |
| 4a | Ammonia | 8.40 | 11.7 | 10.0 |
| 8 | TSS | 2.54 | 9.09 | 5.82 |
| 9 | Total Lead | 0.00800 | 0.0733 | 0.0407 |
| 9 | Total Zinc | 0.274 | 0.267 | 0.271 |
| 14 | Phenolics | 0.0170 | 0.00575 | 0.0114 |
|  | Flow ($m^3$/tonne) | 0.214 | 1.71 | 0.962 |

Note: * The performance adopted by the ELSS was the average performance of Dofasco and Stelco Hilton Works ironmaking processes.

## Table 4.5
## Stelco Lake Erie Works MISA Loading Allocation

| Parameter | MISA (kg/day) | Percent Allocation | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Coke | Iron | Steel | Vacuum Degassing | Concast | Hotform | Central Power | SE Cooling Water |
| TSS | 95.602 | 7.34 | 14.6 | 24.4 | 2.44 | 29.3 | 14.6 | 7.3 | 2.44 |
| Oil & Grease | 27.549 | 5 | - | - | - | 30 | 65 | - | - |
| Ammonia | 1.653 | 10 | 90 | - | - | - | - | - | - |
| Total Cyanide | 2.232 | 40 | 60 | - | - | - | - | - | - |
| Phenolics (4AAP) | 0.047 | 25 | 75 | - | - | - | - | - | - |
| Total Lead | 0.633 | - | 10 | 47 | 20 | 23 | - | - | - |
| Total Zinc | 1.275 | - | 10 | 47 | 20 | 23 | - | - | - |
| Benzene | 0.005 | 100 | - | - | - | - | - | - | - |
| Benzo(a)pyrene | 0.010 | 100 | - | - | - | - | - | - | - |
| Naphthalene | 0.006 | 100 | - | - | - | - | - | - | - |
| Flow ($m^3$/day) | 19,607 | 4.9 | 14.6 | 24.4 | 2.44 | 29.3 | 14.6 | 7.3 | 2.44 |

# Table 4.6
# Production Based Loadings (g/tonne) for BAT Model Process Subcategories in U.S. and Ontario

| ATG | Parameter | Best in Ontario (BAT #1) | Best in the USA (BAT #2) | ELSS | U.S.EPA |
|---|---|---|---|---|---|
| | **Cokemaking** | | | | |
| | **Plant** | **Stelco L.E.W** | **Inland Steel** | **ELSS** | **U.S.EPA** |
| | Flow ($m^3$/tonne) | 0.6 | 0.54* | 0.79 | 0.64 |
| 2 | Cyanide Total | 0.546 | 4.53 | 3.66 | 1.75 |
| 4a | Ammonia + Ammonium | 0.108 | 1.17 | 3.28 | 4.47 |
| 8 | Total Suspended Solids | 4.42 | 39.0 | 7.74 | 48.5 |
| 14 | Phenolics (4AAP) | 0.0074 | 0.028 | 0.029 | 0.0134 |
| 17 | Benzene | 0.00709 | 0.0019 | 0.00709 | 0.00638 |
| 19 | Benzo(a)pyrene | 0.00709 | 0.0139 | 0.00709 | 0.00638 |
| 19 | Naphthalene | 0.00709 | 0.0073 | 0.00709 | 0.00638 |
| 25 | Oil and Grease | 0.859 | 0.869 | 1.58 | 2.81 |
| | **Ironmaking** | | | | |
| | **Plant** | **Stelco L.E.W.** | **Bethlehem Steel** | **ELSS** | **U.S.EPA** |
| | Flow ($m^3$/tonne) | 0.8 | 0.26 | 0.962 | 0.29 |
| 2 | Cyanide Total | 0.440 | 0.0360 | 0.0503 | 0.350 |
| 4a | Ammonia + Ammonium | 0.469 | 16.0 | 10.0 | 1.33** |
| 8 | Total Suspended Solids | 4.41 | 2.20 | 5.82 | 6.94 |
| 9 | Total Lead | 0.0190 | 0.00500 | 0.0407 | 0.0175 |
| 9 | Total Zinc | 0.0410 | 0.0520 | 0.271 | 0.0292 |
| 14 | Phenolics (4AAP) | 0.0110 | 0.0220 | 0.0114 | 0.0117 |

NOTE: * Light oil recovery not included

** The US steel plants were granted a variance from the ammonia limitation.

# Table 4.6
## Production Based Loadings (g/tonne) for BAT Model Process Subcategories in U.S. and Ontario

| ATG | Parameter | Best in Ontario (BAT #1) | Best in the USA (BAT #2) | ELSS | U.S.EPA |
|---|---|---|---|---|---|
| | **Sintering** | | | | |
| **Plant** | | | **Bethlehem Steel** | **ELSS**[Note 1] | **U.S.EPA** |
| | Flow (m$^3$/tonne) | - | 0.46 | 7.55 | 0.5 |
| 2 | Cyanide Total | - | 0.0640 | - | 0.601 |
| 4a | Ammonia + Ammonium | - | 28.4 | - | 2.25 |
| 8 | Total Suspended Solids | - | 3.95 | 12.8 | 11.9 |
| 9 | Total Lead | - | 0.00900 | 0.400 | 0.0300 |
| 9 | Total Zinc | - | 0.0910 | - | 0.0501 |
| 14 | Phenolics (4AAP) | - | 0.0380 | 0.0370 | 0.0200 |
| 25 | Oil and Grease | - | 2.70 | 10.3 | 2.20 |
| | **Steelmaking** | | | | |
| **Plant** | | **Stelco L.E.W** | **LTV Cleveland** | **ELSS** | **U.S.EPA** |
| | Flow (m$^3$/tonne) | 1.1 | 0.002 | 1.1 | 0.208 |
| 8 | Total Suspended Solids | 6.95 | 0.0083 | 6.95 | 4.95 |
| 9 | Total Lead | 0.071 | 0.00720 | 0.0710 | 0.00720 |
| 9 | Total Zinc | 0.174 | 0.0455 | 0.174 | 0.0208 |
| | **Vacuum Degassing** | | | | |
| **Plant** | | **Stelco L.E.W.** | | **ELSS** | **U.S.EPA** |
| | Flow (m$^3$/tonne) | 0.11 | - | Note 2 | 0.10 |
| 8 | Total Suspended Solids | 0.695 | - | Note 2 | 2.48 |
| 9 | Total Lead | 0.0300 | - | Note 2 | 0.00626 |
| 9 | Total Zinc | 0.0610 | - | Note 2 | 0.0104 |

Note 1: Data based on the Post-MISA performance of sintering process of the Stelco Hilton Works

# Table 4.6
# Production Based Loadings (g/tonne) for BAT Model Process Subcategories in U.S. and Ontario

| ATG | Parameter | Best in Ontario (BAT #1) | Best in the USA (BAT #2) | ELSS | U.S.EPA |
|---|---|---|---|---|---|
| **Continuous Casting** | | | | | |
| **Plant** | | **Stelco L.E.W.** | **Inland Steel IH** | **ELSS** | **U.S.EPA** |
| | Flow ($m^3$/tonne) | 1.4 | 0.076 | Note 2 | 0.10 |
| 8 | Total Suspended Solids | 8.37 | 1.40 | Note 2 | 2.48 |
| 9 | Total Lead | 0.0345 | 0.00870 | Note 2 | 0.00628 |
| 9 | Total Zinc | 0.0850 | 0.00800 | Note 2 | 0.0104 |
| 25 | Oil and Grease | 2.24 | 0.160 | Note 2 | 0.698 |
| **Hot Forming** | | | | | |
| **Plant** | | **Stelco L.E.W.** | **USS Gary Works** | **ELSS** | **U.S.EPA** |
| | Flow ($m^3$/tonne) | 0.85 | 0.36 | Note 2 | 10.7 |
| 8 | Total Suspended Solids | 3.89 | 1.09 | Note 2 | 105 |
| 25 | Oil and Grease | 4.75 | 2.38 | Note 2 | 21.4 |
| **Finishing Operations** | | | | | |
| **Plant** | | **Stelco Hilton Works** | **National Steel Midwest** | **ELSS** | **U.S.EPA** |
| | Flow ($m^3$/tonne) | 8.6 | 6.1 | Note 2 | Note 3 |
| 8 | Total Suspended Solids | 75.1 | 29.0 | Note 2 | Note 3 |
| 9 | Total Lead | 0.0176 | - | Note 2 | Note 3 |
| 9 | Total Zinc | 1.05 | 0.330 | Note 2 | Note 3 |
| 9 | Total Chromium | 0.114 | 0.310 | Note 2 | Note 3 |
| 25 | Oil and Grease | 21.2 | 14.0 | Note 2 | Note 3 |

Note 2: ELSS recommended the use of the existing performance as measured during the MISA monitoring period.

Note 3: Not available for the finishing operation. U.S.EPA guidelines were based on sub-segments of the finishing operations.

## Table 4.7
## Long Term Average Process Loadings (kg/day)
## Algoma Steel

| ATG | Parameter | Option #1 | Option #2 | Option #3 | Option #4 |
|---|---|---|---|---|---|
| 2 | Cyanide Total | 4.43 | 14.2 | 4.43 | 11.6 |
| 4a | Ammonia + Ammonium | 3.26 | 103 | 3.26 | 72.8 |
| 8 | Total Suspended Solids | 254 | 189 | 983 | 1240 |
| 9 | Total Lead | 0.811 | 0.196 | 5.09 | 5.59 |
| 9 | Total Zinc | 3.11 | 0.836 | 9.21 | 11.1 |
| 14 | Phenolics (4AAP) | 0.0914 | 0.223 | 0.0914 | 0.160 |
| 17 | Benzene | 0.0219 | 0.00586 | 0.0219 | 0.0219 |
| 19 | Benzo(a)pyrene | 0.0219 | 0.0428 | 0.0219 | 0.0219 |
| 19 | Naphthalene | 0.0219 | 0.0225 | 0.0219 | 0.0219 |
| 25 | Oil and Grease | 77.2 | 37.8 | 344 | 365 |
| Capital Cost ($ Million) | | 112.24 | 94.26 | 50.54 | 26.75 |
| Annual Operating & Maintenance Cost ($ Million/year) | | 18.64 | 15.25 | 7.01 | 3.50 |

## Table 4.8
## Long Term Average Process Loadings (kg/day)
## Dofasco Inc.

| | Parameter | Option #1 | Option #2 | Option #3 | Option #4 |
|---|---|---|---|---|---|
| 2 | Cyanide Total | 4.64 | 18.2 | 4.64 | 14.8 |
| 4a | Ammonia + Ammonium | 3.07 | 94.6 | 3.07 | 69.5 |
| 8 | Total Suspended Solids | 148 | 182 | 284 | 343 |
| 9 | Total Lead | 0.685 | 0.129 | 0.871 | 1.44 |
| 9 | Total Zinc | 1.64 | 0.610 | 1.78 | 3.81 |
| 14 | Phenolics (4AAP) | 0.0912 | 0.235 | 0.0912 | 0.179 |
| 17 | Benzene | 0.0281 | 0.00754 | 0.0281 | 0.0281 |
| 19 | Benzo(a)pyrene | 0.0281 | 0.0551 | 0.0281 | 0.0281 |
| 19 | Naphthalene | 0.0281 | 0.0290 | 0.0281 | 0.0281 |
| 25 | Oil and Grease | 44.1 | 18.7 | 71.9 | 74.8 |
| Capital Cost ($ Million) | | 70.21 | 56.25 | 65.41 | 50.00 |
| Annual Operating & Maintenance Cost ($ Million/year) | | 9.71 | 5.80 | 8.70 | 4.60 |

## Table 4.9
## Long Term Average Process Loadings (kg/day)
## Stelco Hilton Works

| ATG | Parameter | Option #1 | Option #2 | Option #3 | Option #4 |
|---|---|---|---|---|---|
| 2 | Cyanide Total | 4.15 | 15.1 | 4.39 | 12.4 |
| 4a | Ammonia + Ammonium | 2.87 | 124 | 5.60 | 73.6 |
| 8 | Total Suspended Solids | 392 | 263 | 2640 | 2690 |
| 9 | Total Lead | 0.808 | 0.140 | 1.51 | 2.34 |
| 9 | Total Zinc | 4.37 | 1.60 | 11.0 | 12.2 |
| 9 | Total Chromium | 0.407 | 1.11 | 0.884 | 0.884 |
| 14 | Phenolics (4AAP) | 0.128 | 0.256 | 0.114 | 0.171 |
| 17 | Benzene | 0.0232 | 0.00623 | 0.0232 | 0.0232 |
| 19 | Benzo(a)pyrene | 0.0232 | 0.0456 | 0.0232 | 0.0232 |
| 19 | Naphthalene | 0.0232 | 0.0239 | 0.0232 | 0.0232 |
| 25 | Oil and Grease | 134 | 76.2 | 708 | 721 |
| Capital Cost ($ Million) | | 164.79 | 182.13 | 66.51 | 40.10 |
| Annual Operating & Maintenance Cost ($ Million/year) | | 23.45 | 25.14 | 8.78 | 2.80 |

## Table 4.10
## Long Term Average Process Loadings (kg/day)
## Atlas Specialty Steel

| ATG | Parameter | Option #1 | Option #2 | Option #3 |
|---|---|---|---|---|
| 8 | Total Suspended Solids | N/A | 2.70 | 23.1 |
| 9 | Total Zinc | N/A | 0.0034 | 0.502 |
| 9 | Total Nickel | N/A | 0.0019 | 0.681 |
| 9 | Total Chromium | N/A | 0.010 | 0.151 |
| 25 | Oil and Grease | N/A | 1.10 | 10.1 |
| Capital Cost ($ Million) | | N/A | 6.24 | 0.35 |
| Annual Operating & Maintenance Cost ($ Million/year) | | N/A | 0.86 | 0.08 |

## Table 4.11
## Long Term Average Process Loadings (kg/day)
## Lake Ontario Steel Company

| ATG | Parameter | Option #1 | Option #2 | Option #3 |
|---|---|---|---|---|
| 8 | Total Suspended Solids | 17.0 | 0 | 12.7 |
| 9 | Total Lead | 0.088 | 0 | 0.0388 |
| 9 | Total Zinc | 0.170 | 0 | 0.0829 |
| 25 | Oil and Grease | 8.50 | 0 | 2.59 |
| Capital Cost ($ Million) | | 0.21 | 2.20 | 0.75 |
| Annual Operating & Maintenance Cost ($ Million/year) | | 0.07 | 0.71 | 0.15 |

# Table 4.12
# Long Term Average Loadings (kg/day)
# IVACO Rolling Mills

| ATG | Parameter | Option #1 | Option #2 | Option #3 |
|---|---|---|---|---|
| 8 | Total Suspended Solids | 9.90 | 0 | 12.9 |
| 9 | Total Lead | 0.0603 | 0 | 0.0394 |
| 9 | Total Zinc | 0.110 | 0 | 0.0841 |
| 25 | Oil and Grease | 5.00 | 0 | 2.62 |
| Capital Cost ($ Million) | | 0.21 | 2.22 | 0.50 |
| Annual Operating & Maintenance Cost ($ Million/year) | | 0.07 | 0.66 | 0.15 |

## Table 4.13
## Lowest Cost BAT Option

| Firm | Capital Cost ($'M) | O & M Costs ($'M/yr) | Before-Tax Annualized Cost ($'M/yr) | After-Tax Annualized Cost ($'M/yr) |
|---|---|---|---|---|
| **Integrated Steel Mills** | | | | |
| **Algoma** | 26.8 | 3.5 | 7.9 | 4.7 |
| **Dofasco** | 50.0 | 4.6 | 13.4 | 8.1 |
| **Stelco (Hilton)** | 40.1 | 2.8 | 9.3 | 5.6 |
| **Stelco (LEW)** | - | - | - | - |
| **Subtotal** | 116.9 | 10.9 | 30.6 | 18.4 |
| **Non-Integrated Steel Mills (Mini and Specialty Steel Mills)** | | | | |
| **Atlas** | 0.35 | 0.08 | 0.14 | 0.09 |
| **Ivaco** | 0.50 | 0.15 | 0.24 | 0.14 |
| **Lasco** | 0.75 | 0.15 | 0.28 | 0.17 |
| **Subtotal** | 1.6 | 0.38 | 0.66 | 0.40 |
| **Total** | 118.5 | 11.3 | 31.3 | 18.8 |

# Chapter 5
# Effluent Limits

## 5.1 Introduction

This section outlines the method used for the development of plant limits using the ELSS recommended option.

The development of effluent limits was based on the statistical procedures outlined in the Issue Resolution Process Final Report Summary[2] on Monitoring Data Analysis and Limit Setting and Form of Limits.

No loading limits were developed for cooling water streams. The sector plants are required to monitor these streams to detect potential leaks from process heat transfer equipments. Parameters to be monitored at each cooling water effluent monitoring stream were selected on the basis of the type of process operations associated with the cooling water stream.

No limits were developed for storm water discharges. The Sector plants will instead conduct a storm water control study according to a regulated Protocol.

## 5.2 Limit Setting Process

The limit setting process is based on the following steps:

i) Determination of the long term average (LTA) concentration and flow or loading of the BAT(EA) plants.

ii) Determination of the variability factors (VF) from the BAT(EA) plants.

iii) Calculation of the effluent limit as the product of LTA and VF.

The long term average concentration or loading is defined as the expected performance from a well designed, maintained and operated treatment system. The long term average is not a limitation, but rather a design value which the treatment system should be designed to attain over the long term. The LTA loading is calculated as the product of the concentration and the flow of the BAT.

Fluctuations in the pollutant loadings occur at well designed and properly operated treatment systems. These fluctuations may reflect normal imbalances in flow, raw waste load of a particular pollutant, chemical feed, and mixing flows within the treatment facilities.

Day-to-day variability in the loading of a pollutant discharged from a well designed and operated treatment system is accounted for in the effluent limits by the use of a "variability factor". The application of a variability factor allows the calculation for an upper bound for the loading of a particular pollutant.

On the average, a specified percentile of randomly observed daily values from a treatment system at a known mean loading would be expected to fall below this bound. The 99th percentile for the daily maximum and the 95th percentile for the monthly average values are commonly used and accepted levels in the development of the U.S.EPA effluent limits regulations.

These percentiles provide a balance between appropriate considerations of day-to-day variation in a properly operating plant and the necessity to ensure that a plant is operating properly.

The calculation of the variability factors depends on the distribution of the data. The data generally follow two main distribution: normal and log-normal. If the data fits both the normal and the log-normal distributions, the log-normal distribution is used to calculate the effluent limits. In the event that the data distribution is neither normal nor log-normal, non-parametric methods are used.

The variability factor VF(1) describes the variability of daily observations. The variability factor VF(30) describes the variability of a mean based on (30) samples per month where as the variability factor VF(4) describes the variability of a mean based on four (4) samples per month.

The performance value is the product of the long term average and the appropriate variability factor to obtain a maximum daily or a monthly average value.

## 5.3 Form of Limits and Monitoring Frequency

The three options for the type of limits that were considered in the development of the limits were:

- production-based loading limits
- loading-based limits
- concentration-based limits

The production-based loading approach was adopted for the development of limits. This was based on the assumption that the effluent contaminant loading at each process subcategory is proportional to the production of that process. The U.S.EPA have used a similar approach and demonstrated its suitability.

Effluent limits as daily maximum and monthly average values were selected. Daily maximum limits represent a maximum value that the plant shall not exceed in every day measurement.

Monthly average limits were based on either a 30-day average or a 4-week average. Monthly averages based on 30-day measurements were selected for parameters which are indicative of technology performance and common to all plants in the sector. Parameters that were selected for weekly monitoring were indicative of specific process subcategory

## 5.4 Parameter Selection for Limit Setting

As previously indicated in Chapter 4, there were 53 parameters which were identified by the QA/QC evaluation as parameters with reliable data for limits. During the BAT evaluation, only 12 parameters with demonstrated performance values were identified. Effluent limits were developed for these parameters. The 12 parameters are:

- Cyanide Total
- Ammonia plus Ammonium
- Total Suspended Solids
- Total Chromium
- Total Lead
- Total Nickel
- Total Zinc
- Phenolics (4AAP)
- Benzene
- Benzo(a)pyrene
- Naphthalene
- Oil and Grease

The environmental significance of the limited parameters are outlined in the Ministry's reports "The Effluent Monitoring Priority Pollutants List[6]" and the "Candidate Substance List for Bans or Phase-Outs or Reductions - Multimedia Revision[12]".

The following is a rationale for not selecting the following parameters for the purpose of the development of effluent limits:

**Volatile suspended solids** are not limited since they are directly controlled by limiting the total suspended solids.

**The non-halogenated volatile compounds** such as toluene, m-xylene and p-xylene and o-xylene which are selected at the cokemaking process will not be limited since benzene is a representative parameter for these compounds. The control of benzene should therefore result in effective control of these compounds.

**The polynuclear Aromatic Hydrocarbon compounds:**

Benzo(a)pyrene and naphthalene will be limited as surrogate parameters for the PAH compounds in the Analytical Test Group (ATG) 19. The control of benzo(a)pyrene and naphthalene will result in the control of other PAH's compounds since these compounds are treated by the same technology selected for naphthalene and benzo(a)pyrene.

A Study conducted by the Wastewater Technology Center (WTC)[4] for the Ministry indicated that there was a linear relationship between the removal of total suspended solids and polynuclear aromatic hydrocarbons by a filter treating effluents from a biological treatment plant. Thus, the control of total suspended solids will result in the control of the polynuclear aromatic hydrocarbons.

**Cadmium** is selected at the Stelco Lake Erie Works. Its concentration ranges from .002 mg/L to .008 mg/L. There are no known technology to control cadmium at or below this concentration.

**Vanadium** is selected at only one effluent stream at the Stelco Hilton Works at low concentration range (.051 mg/L to 0.108 mg/L) based on 5 samples. There are no data available to demonstrate control of this parameter below the observed levels. No effluent limitations will be set for Vanadium.

**Selenium** is selected at the final effluent of the Stelco Lake Erie Works. Its concentration ranges from .006 mg/L to .017 mg/L. There are no data available to demonstrate the control of this parameter below the observed levels. Selenium will not be limited.

**Mercury** is selected at the final effluent of Stelco Lake Erie Works at an average concentration of 0.48 ug/L based on 9 samples. The presence of mercury is attributed to impurities in the coal used. Another possible source is impurities in the caustic used at the ammonia stills. Mercury is a parameter slated for the ban and phase-out. Currently there is no known technology to reduce the mercury levels below the observed levels.

**The bromoform and dibromochloromethane** compounds are selected at the Stelco Lake Erie Works as a result of the use of chlorine as a strong oxidizing agent to remove cyanide and ammonia and ammonium compounds. The sum of the levels of these compounds (55 ug/L) are consistently less than the drinking water objectives (350 ug/L). In addition, there are no data on treatability by BAT(EA) for these compounds. No effluent limits will be set for these compounds.

The control of **aluminum, iron and dissolved organic carbon** are not considered for limits since there are no specific demonstrated performance data for these parameters. In addition, iron and aluminum are largely present in particulate form and can be controlled through the removal of suspended solids.

## 5.5 Plant Effluent Limits

The daily maximum and monthly average loading limits for each plant were developed on the basis of the ELSS recommended option. As mentioned earlier, the ELSS recommended option focused on the application of best available technology for the processes (i.e. cokemaking, ironmaking and steelmaking) that were the major sources of toxic pollutants. Effluent limits for continuous casting, hotforming and finishing operations were based on the performance of the existing technology for these processes.

The daily maximum production-based loading factor for each limited parameter associated with each process was calculated as the product of the long term average production-based loading (LTA) and VF(1). The monthly average production-based loading factor for each limited parameter designated for 30-day monitoring was calculated as the product of LTA and VF(30). The monthly average production-based loading factor for each parameter designated for weekly monitoring was calculated as the product of LTA and VF(4).

The daily maximum loading limit for each parameter was then calculated as the product of daily maximum production-based loading of the parameter and the reference production capacity of the process subcategory. Similarly, the monthly average loading limit for each parameter was calculated as the product of monthly average production-based loading of the parameter and the reference production capacity of the process subcategory.

The plant limits were calculated as the sum of the limits for each parameter from each process subcategory.

The reference production capacity rates for each process subcategory at each plant are shown in Table 5.1.

The production-based daily maximum and monthly average loading limits for the processes to be retrofitted with best available technology are shown in Table 5.2.

The production-based daily maximum and monthly average loading limits for the processes which were limited at the performance levels, measured during the monitoring period, are shown under the discussion for each plant.

The following outlines the development of effluent loading limits for each iron and steel plant.

## A: Integrated Steel Plants

### Algoma Steel

The effluent loading limits for the plant were based on the application of the ELSS option for the cokemaking and ironmaking process subcategories. The other processes (i.e. steelmaking, continuous casting, hot forming and finishing) were limited at their existing performance. As pointed out earlier, the finishing operations at Algoma steel consists of acid pickling and cold rolling only.

The performance values shown in Table 5.2 were used to develop limits in kg/d for the cokemaking and ironmaking.

The maximum daily and monthly average production-based loadings shown in Table 5.3 which were measured during the MISA monitoring period were used to develop limits in kg/d for the steelmaking, continuous casting and hotforming and finishing.

Although the existing performance of the steelmaking was used, Algoma Steel agreed to improve the concentration performance of the steelmaking clarifier from 75 mg/L to 20 mg/L.

The loadings shown in the shaded areas in Table 5.3 for the continuous casting, hotforming and finishing operations represented the existing loadings for the parameters that were not produced by these processes. They were included in the calculation of the plant limits since these processes were centrally treated together with the cokemaking and ironmaking processes at the Algoma's Main Filter Plant. Concentrations of the parameters shown in the shaded areas were measured at levels lower than the RMDL for organic substances (considered as RMDL/10 for loading calculations), and were at levels around the RMDL for other contaminants (i.e. lead, zinc, ammonia, cyanide and phenolics).

The total plant loading limits in kg/d are shown in Table 5.4.

### Dofasco Inc.

The effluent limits for Dofasco were based on retrofitting the cokemaking, ironmaking and steelmaking processes. Loading limits for hotforming, continuous casting, vacuum degassing and #1 Acid Regeneration Plant (#1ARP) were based on the performance which was measured during the MISA monitoring period.

The performance values shown in Table 5.2 were used to develop limits in kg/d for the cokemaking, ironmaking and steelmaking.

The maximum daily and monthly average production-based loadings shown in Table 5.5, measured during the MISA monitoring period, were used to calculate effluent limits, in kg/d, for the vacuum degassing, continuous casting and hotforming, and #1 Acid Regeneration processes. Since wastewaters from the vacuum degassing, continuous casting and hotforming processes are centrally treated at the #2 Hotmill Filter Plant and since it was not possible to allocate the measured loadings to each specific process, the loading limits for the #2 Hotmill filter effluent were calculated using the reference production capacity of the hotforming process.

The effluent loading limits for the plant in kg/d are outlined in Table 5.6. The plant loading limits do not include those for the finishing operations (i.e. cold rolling, pickling and hot coating) since all the wastewaters generated from these operations are treated at the Hamilton-Wentworth Regional Municipality Sewage Treatment Plant.

### Stelco Hilton Works

The effluent loading limits for the plant are based on the application of the best available technology for the cokemaking operations. The other processes (i.e. continuous casting, hot forming and finishing) were limited at their existing performance.

Stelco Hilton Works has a dry-gas cleaning system for its steelmaking operation and therefore there is no wastewater discharge from this subcategory.

As indicated earlier, the combined operation of the ironmaking and sintering was limited at the post-MISA performance since any further flow reduction may require Stelco to dismantle and completely rebuild their system.

The performance values shown in Table 5.2 were used to develop limits in kg/d for the cokemaking operation.

The maximum daily and monthly average production-based loadings shown in Table 5.7, were used to develop limits in kg/d for the sintering, ironmaking, continuous casting, hotforming and finishing operations.

As in the case of Algoma Steel, the loadings shown in the shaded areas in Table 5.7 represented the existing loadings for the parameters that were not produced by these processes, but were included in the calculation of the plant limits since these processes were centrally treated together with the cokemaking and ironmaking process wastewaters at the East Side Filter Plant. Concentrations of the parameters shown in the shaded areas were measured at levels lower than the RMDL for organic substances (considered as RMDL/10 for loading calculations), and were at levels around the RMDL for other contaminants (i.e. lead, zinc, ammonia, cyanide and phenolics).

The loadings from the blowdown water associated with the cooling water systems for the hotforming and finishing operation (Z-line) (Table 5.8) were added to the plant limits. These loading contributions in mass per unit time (kg/day), are not dependent on the rate of process production.

The total plant loading limits are shown in Table 5.9.

The #2 Rod Mill plant, which is located outside the Stelco Hilton Works, is a hot rolling facility. The effluent limits for this plant are based on its performance during the MISA monitoring period. The existing production-based loadings (g/tonne) and the loading limits for the #2 Rod Mill are outlined in Tables 5.10 and 5.11 respectively.

## Stelco Lake Erie Works

The Stelco Lake Erie Works (BAT #1) is the most modern integrated iron and steel plant with a central treatment facility. The process-specific recirculation systems are operated with recycle rates ranging from 85% to 98%. The plant has recirculating system for all non-contact cooling water.

The production-based loadings (g/tonne) and the effluent loading limits for the Stelco Lake Erie Works, shown in Table 5.12 and Table 5.13 respectively, are based on the existing performance of the plant.

As indicated in section 4.5, allocation of production-based loadings to each process was necessary in order to calculate a plant limit using the reference production rates of each process.

The allocation scheme used to develop the plant limits differed from that followed under section 4.5 due to:

i) the assumption that effluent concentrations attainable for a contaminant generated from several processes should be the same since each subcategory flow is processed through the same treatment train and that the influent concentration is within the operating range of the train;

ii) the contribution of cooling water blowdown which was added to the loadings from the steelmaking and hotforming operations.

The Stelco Lake Erie Works effluent limits are comparable with those of the U.S.EPA new source performance standards as shown in Table 5.13.

### B: Non-Integrated Steel Plants:

#### Atlas Specialty Steels

Atlas Speciality Steels is the only speciality steel plant in Ontario. Unlike the integrated and mini-mills, Atlas produces a over 300 different grades of steel. These variability in grades of steel result in effluent characteristics different from those of the integrated and mini-mills.

Based on the recent restructuring, it is anticipated that the percentage of stainless steel produced will increase as a result of the closure of Atlas sister plant in Watervliet, New York.

Wastewaters are mainly generated from the vacuum degassing, continuous casting and hot forming operations. The steelmaking has a dry gas cleaning system and therefore there is no wastewater discharge from this operation.

The existing technology train consists of settling basins followed by chemically assisted precipitation followed by filtration. A portion of the filtered water is recycled to the process and the balance (blowdown) is discharged to Welland River. The backwash from the filter is clarified in the settling tank and then directed to the filter for treatment.

The effluent loading limits for Atlas Speciality steels were based on the use of the concentration performance of the existing technology train but with a flow reduction of 70% from the flow that was observed during the MISA monitoring period.

This flow reduction is mainly achieved through the introduction of tight water recycle systems for the continuous casting and hotforming operations.

The shut down of the pickling process has resulted in the elimination of concentrated wastes including nitric/hydrofluoric acids, sulfuric acid and salt pot sludge. As a result, a better performance of the North Plant Water Treatment facility is expected due to the elimination of this type of wastewaters and the reduced flow.

The production-based loading factors and the plant loading limits are outlined in Tables 5.14 and 5.15 respectively.

**Mini-Mills - Lasco and Ivaco Rolling Mill**

In these mini-mills, the steelmaking is a dry gas cleaning system and therefore there is no wastewater discharge from this process.

The wastewaters are mainly generated from the continuous casting and hotforming operations.

Ivaco was operating with a closed loop system with no process wastewater discharge during the MISA monitoring period. Ivaco could not maintain this mode of operation due to scaling which had an adverse effect on the quality of its products.

Plant effluent limits for Lasco and Ivaco rolling mills were based on a flow of 0.85 $m^3$ per tonne which was equivalent to the BAT#1 flow for the hotforming operations. The blowdown is treated through clarification followed by filtration.

The production based loading factors (g/tonne), adopted for the Mini-Mills, are outlined in Table 5.16. The loading limits in kg/d for Lasco and Ivaco are outlined in Table 5.17 and 5.18 respectively.

## 5.6 Oil and Grease Effluent Limits:

The proposed oil and grease effluent limits, outlined in section 5.5, for the sector plants reflect the existing technology performance during the MISA monitoring period. Oil and grease is mainly generated from continuous casting and hotforming and finishing operations.

Industry raised concerns over the proposed effluent limits for oil and grease stating that:

> The analytical method which is documented in the Ministry's analytical protocol does not accurately quantify the presence of oil and grease. The current analytical method "Solvent Extractables" may result in detecting other organic compounds which are not oils or greases; and

> The limits were based on technologies that control oil and grease but not solvent extractables.

The Ministry acknowledged these concerns but was also concerned about not including some form of control on oil and grease discharges in the regulation. As a compromise, the Ministry proposed a limit of 15 mg/l, as a monthly average of four, weekly samples, to apply until such time as information becomes available to allow the development of more definitive limits.

This proposed limit reflects the current Ministry Guideline level of 15 mg/l which has been used in certificates of approval for two plants in this sector. All sector plants are currently at or significantly below the 15 mg/L monthly average limit.

## 5.7 Existing Requirements for Ontario Facilities

The Ontario Ministry of Environment and Energy presently employs a variety of measures to limit water pollution, including voluntary measures, formal programs, Control Orders, Requirements and Direction and Certificates of Approval. Legally enforceable Control Orders under Section 6 of the Environmental Act may be issued to any existing plant. Control Orders define abatement actions and compliance dates by which these actions must be completed. Legally enforceable Requirements and Directions may also be issued under Section 51 of the Ontario Water Resources Act[13]. Certificates for Approval for wastewater treatment works are issued under the Ontario Water Resources Act.

The existing requirements which are currently applied to Algoma Steel and Stelco Lake Erie Works are outlined in Table 5.19. Requirements for the Stelco Hilton works, Dofasco Inc. and Atlas Specialty Steels are based on the existing Ontario Effluent Quality Guidelines[14]: Phenolics 20 ug/L, Oil and Grease 15 mg/L, Suspended solids 15 mg/L, Zinc 1 mg/L, Chromium 1 mg/L, Ammonia 10 mg/L.

## 5.8 Limits in Other Jurisdictions

**Canadian Provinces**

A comparison of requirements for control of Iron and Steel plant discharges in other canadian provinces is mainly focused on mini-mills since there are no integrated steel plants outside Ontario.

Monthly average concentration limits adopted in Quebec and Saskatchewan and those proposed for the Ontario mini-mills (Lasco and Ivaco) are shown in Table 5.20. Quebec limits adopted for zinc and lead (0.1 mg/L) are less stringent than those proposed for the Ontario mini-mills (0.1 and 0.15 mg/L).

**United States**

In the United States, the Environmental Protection Agency's Effluent Limitations Guidelines for the Iron and Steel Manufacturing Sector were issued in May 1982 and amended in July 1984.

These guidelines are used by the States within the National Pollutant Discharge Elimination System (NPDES) framework. They provide production-based loadings for a total of 12 parameters. Process-based categorization was adopted for the development of effluent limits for the Iron and Steel Sector since the wastewaters of the various processes (i.e. cokemaking, ironmaking, steelmaking, hot forming and finishing) contain different pollutants requiring treatment by different control system.

Table 5.21 shows the U.S. Effluent Limitation Guidelines and the production-based loadings that were used in the development of the Ontario's limits.

The U.S. Effluent Limitation Guidelines expressed as production-based loadings are less stringent than those used in the development of the Ontario's limits especially for total suspended solids and toxic organic compounds.

For example, total suspended solids loadings for U.S. plants are based on 131 g/tonne for cokemaking and 26 g/tonne for ironmaking operations while the limits for Ontario are based on 11.9 g/tonne and 10.6 g/tonne respectively.

Other comparisons between Ontario and United States include benzene, benzo(a)pyrene and Naphthalene where the limits are based on 0.032 g/tonne of coke produced for the U.S. compared to 0.011 g/tonne of coke produced for Ontario.

**Other Jurisdictions**

The requirements under the proposed Ontario's Regulation (cokemaking process) are more stringent than those in Germany and Sweden as shown in Table 5.22.

Ontario's Requirements are more stringent than those in Japan and South Korea. As shown in Table 5.20, the Ontario limits for total suspended solids reflect a concentration of 15 mg/L compared to 70 mg/L in Japan and 100 mg/L in South Korea.

## 5.9 Environmental Benefits

The implementation of the proposed Iron and Steel Manufacturing regulation would decrease the combined total loadings discharged by the plants in the sector by approximately 3,600 tonnes per year, distributed as follows:

- 2,693 tonnes/yr conventional contaminants
- 907 tonnes/yr non-conventional and toxic contaminants

The loading reductions for each limited parameter which are expected to take place with the implementation of the limits regulation are outlined in Table 5.23.

Both Hamilton Harbour and the St. Marys River have been identified by the IJC as Areas of Concern needing immediate attention and clean up. Under the Great lakes Water Quality Agreement, both the Federal and Provincial Governments are required jointly, to develop Remedial Action Plans (RAPs) to identify the problems and outline activities needed to delist the area from being an Area of Concern. This Regulation is a key component to the development of the Ontario plans for the St. Marys River and Hamilton Harbour since:

- There will be reduced concentrations of toxic chemicals being discharged and thus accumulation in the bottom sediments will be reduced.

- Transboundary water pollution from Algoma Steel to the Michigan shoreline of the St. Marys River will be reduced.

- Taste and odour problems in drinking water and fish will be reduced.

## Table 5.1
## Reference Production Capacity (tonnes/day)
## Ontario Iron and Steel Plants

| Process Subcategory | Product | Reference Production Capacity |
|---|---|---|
| **Algoma Steel** | | |
| Cokemaking | Metallurgical Coke | 2,994 |
| Ironmaking | Molten Iron | 6,441 |
| Steelmaking | Raw Steel | 6,577 |
| #1 Continuous Casting | Beams and Blooms | 935 |
| #2 Continuous Casting | Slabs | 5,642 |
| #1 & #2 Tube Mills | Seamless Tubes | 907 |
| Hotforming | Plate and Strip | 11,431 |
| Finishing | Pickled, Cold Rolled, and Tempered Coils | 1,470 |
| **Atlas Specialty Steels** | | |
| Vacuum Oxygen Refining | Refined Steel | 680 |
| Continuous Casting | Billet and Blooms | 427 |
| Hotforming | Stainless, Rock Drill Steels | 427 |
| **Dofasco Inc.** | | |
| Cokemaking | Metallurgical Coke | 4,264 |
| Ironmaking | Molten Iron | 9,435 |
| Steelmaking | Raw Steel | 9,042 |
| Vacuum Degassing | Refined Steel | 904 |
| Continuous Casting | Slabs | 9,042 |
| Hotforming | Plate and Strip | 12,410 |
| **IVACO Rolling Mills** | | |
| Continuous Casting | Billets | 1,701 |
| Hotforming | Wire Rods | 2,500 |

# Table 5.1
## Reference Production Capacity (tonnes/day)
## Ontario Iron and Steel Plants

| Process Subcategory | Product | Reference Production Capacity |
|---|---|---|
| **Lake Ontario Steel Company (LASCO)** | | |
| Continuous Casting | Billets | 3,818 |
| Hotforming | Structural Steel | 3,818 |
| **Stelco Hilton Works** | | |
| Cokemaking | Metallurgical Coke | 4,500 |
| Ironmaking | Molten Iron | 8,600 |
| Sintering | Sinter | 1,800 |
| Steelmaking | Raw Steel | 9,200 |
| Continuous Casting | Slabs | 9,200 |
| #3 Bloom and Billet | Bloom and Billet | 3,700 |
| Hotforming | Plate and Strip | 10,163 |
| Finishing | Pickled, Cold Rolled, Hot Coated, Tempered Coils and Sheets | 6,900 |
| # 2 Rod Mill | Rods | 2,721 |
| **Stelco Lake Erie Works** | | |
| Cokemaking | Metallurgical Coke | 1,734 |
| Ironmaking | Molten Iron | 5,960 |
| Steelmaking | Raw Steel | 6,800 |
| Vacuum Degassing | Refined Steel | 6,800 |
| Continuous Casting | Slabs | 6,800 |
| Hotforming | Plate and Strip | 7,500 |

# Table 5.2
# Production-Based Loadings (g/tonne) Adopted by the Effluent Limits Setting Subcommittee

| ATG | Parameter | LTA Conc. (mg/L) | LTA g/tonne | VF (1) | VF(30) VF(4) | Daily Maximum g/tonne | Monthly Average g/tonne |
|---|---|---|---|---|---|---|---|
| **Cokemaking** | | | | | | | |
| Flow Factor = 0.79 m$^3$/tonne | | | | | | | |
| 2 | Cyanide Total | 4.63 | 3.66 | 2.70 | 1.22 | 9.89 | 4.45 |
| 4a | Ammonia | 4.15 | 3.28 | 10.3 | 1.95 | 33.7 | 6.38 |
| 8 | TSS | 9.80 | 7.74 | 3.06 | 1.54 | 23.7 | 11.9 |
| 9 | Total Lead | 0.033 | 0.0261 | 2.20 | 1.10 | 0.0574 | 0.0287 |
| 9 | Total Zinc | 0.018 | 0.0142 | 2.20 | 1.10 | 0.0313 | 0.0156 |
| 14 | Phenolics | 0.0367 | 0.029 | 4.66 | 1.30 | 0.135 | 0.0376 |
| 17 | Benzene | 0.00897 | 0.0071 | 4.50 | 1.50 | 0.0319 | 0.0106 |
| 19 | Benzo(a)pyrene | 0.00897 | 0.0071 | 4.50 | 1.50 | 0.0319 | 0.0106 |
| 19 | Naphthalene | 0.00897 | 0.0071 | 4.50 | 1.50 | 0.0319 | 0.0106 |
| 25 | Oil and Grease | 2.00 | 1.58 | 5.00 | 2.50 | 7.90 | 3.95 |
| **Ironmaking** | | | | | | | |
| Flow Factor= 0.962 m$^3$/tonne | | | | | | | |
| 2 | Cyanide Total | 0.0523 | 0.0503 | 3.96 | 1.75 | 0.199 | 0.0878 |
| 4a | Ammonia | 10.4 | 10.0 | 2.11 | 1.32 | 21.2 | 13.3 |
| 8 | TSS | 6.04 | 5.82 | 4.34 | 1.82 | 25.3 | 10.6 |
| 9 | Total Lead | 0.0423 | 0.0407 | 2.82 | 1.43 | 0.115 | 0.0581 |
| 9 | Total Zinc | 0.281 | 0.271 | 4.18 | 1.80 | 1.13 | 0.486 |
| 14 | Phenolics | 0.0119 | 0.0114 | 4.69 | 1.90 | 0.0534 | 0.0216 |
| **Steelmaking** | | | | | | | |
| Flow Factor = 1.10 m$^3$/tonne | | | | | | | |
| 8 | TSS | 6.32 | 6.95 | 1.89 | 1.05 | 13.1 | 7.28 |
| 9 | Total Lead | 0.0645 | 0.071 | 14.5 | 3.84 | 1.03 | 0.273 |
| 9 | Total Zinc | 0.158 | 0.174 | 6.36 | 2.27 | 1.11 | 0.394 |

# Table 5.3
## Production-Based Loadings (g/tonne)
## Algoma Steel

| ATG | Parameter | LTA Conc. (mg/L) | LTA g/tonne | VF (1) | VF(30) VF(4) | Daily Maximum g/tonne | Monthly Average g/tonne |
|---|---|---|---|---|---|---|---|
| **Steelmaking** | | | | | | | |
| Flow Factor = 1.88 $m^3$/tonne | | | | | | | |
| 8 | TSS | 20.0 | 37.7 | 2.39 | 1.23 | 89.9 | 46.1 |
| 9 | Total Lead | 0.0312 | 0.0587 | 4.73 | 1.91 | 0.278 | 0.112 |
| 9 | Total Zinc | 0.0435 | 0.0819 | 4.39 | 1.74 | 0.359 | 0.143 |
| **#1 Continuous Casting** | | | | | | | |
| Flow Factor= 38.6 $m^3$/tonne | | | | | | | |
| 8 | TSS | 5.00 | 193 | 2.39 | 1.23 | 461 | 237 |
| 9 | Total Lead | 0.030 | 1.16 | 4.73 | 1.91 | 5.48 | 2.21 |
| 9 | Total Zinc | 0.044 | 1.70 | 4.39 | 1.74 | 7.46 | 2.96 |
| 25 | Oil and Grease | 0.380 | 14.7 | 8.33 | 1.67 | 122 | 24.5 |
| **#2 Continuous Casting and Hot Forming** | | | | | | | |
| Flow Factor= 19.3 $m^3$/tonne | | | | | | | |
| 2 | Cyanide Total | 0.00500 | 0.0966 | 2.72 | 1.53 | 0.263 | 0.148 |
| 4a | Ammonia | 0.250 | 4.83 | 4.44 | 1.38 | 21.4 | 6.65 |
| 8 | TSS | 2.51 | 48.4 | 3.68 | 1.24 | 178 | 60.1 |
| 9 | Total Lead | 0.0135 | 0.261 | 3.08 | 1.54 | 0.803 | 0.403 |
| 9 | Total Zinc | 0.0183 | 0.354 | 3.08 | 1.54 | 1.09 | 0.547 |
| 14 | Phenolics | 0.00200 | 0.0387 | 5.38 | 1.82 | 0.208 | 0.0704 |
| 17 | Benzene | 0.00005 | 0.000966 | 19.3 | 6.70 | 0.0186 | 0.00648 |
| 19 | Benzo(a)pyrene | 0.00006 | 0.00116 | 19.3 | 6.70 | 0.0224 | 0.00777 |
| 19 | Naphthalene | 0.00016 | 0.00309 | 19.3 | 6.70 | 0.0596 | 0.0207 |
| 25 | Oil and Grease | 1.22 | 23.5 | 1.95 | 1.08 | 45.9 | 25.4 |

Note: Loadings shown in shaded areas are for parameters not generated by the process but included due to the usage of a centralized treatment plant.

# Table 5.3
# Production-Based Loadings (g/tonne)
# Algoma Steel

| ATG | Parameter | LTA Conc. (mg/L) | LTA g/tonne | VF (1) | VF(30) VF(4) | Daily Maximum g/tonne | Monthly Average g/tonne |
|---|---|---|---|---|---|---|---|
| **#1 Tube Mill** | | | | | | | |
| Flow Factor = 29.4 $m^3$/tonne | | | | | | | |
| 8 | TSS | 9.32 | 274 | 7.17 | 2.02 | 1960 | 553 |
| 25 | Oil and Grease | 1.46 | 43.0 | 5.81 | 1.72 | 250 | 73.8 |
| **#2 Tube Mill** | | | | | | | |
| Flow Factor = 4.4 $m^3$/tonne | | | | | | | |
| 8 | TSS | 3.37 | 14.8 | 2.15 | 1.14 | 31.9 | 16.8 |
| 25 | Oil and Grease | 1.83 | 8.03 | 7.05 | 1.57 | 56.6 | 12.6 |
| **Finishing (Cold Rolling)** | | | | | | | |
| Flow Factor = 2.36 $m^3$/tonne | | | | | | | |
| 2 | Cyanide Total | 0.00500 | 0.0103 | 2.72 | 1.53 | 0.0281 | 0.0158 |
| 4a | Ammonia | 0.250 | 0.516 | 4.44 | 1.38 | 2.29 | 0.710 |
| 8 | TSS | 1.93 | 4.57 | 3.68 | 1.24 | 16.8 | 5.67 |
| 14 | Phenolics | 0.00200 | 0.00413 | 5.38 | 1.82 | 0.0222 | 0.00752 |
| 17 | Benzene | 0.00005 | 0.000118 | 9.30 | 6.70 | 0.00228 | 0.000792 |
| 19 | Benzo(a)pyrene | 0.00006 | 0.000142 | 9.30 | 6.70 | 0.00274 | 0.000950 |
| 19 | Naphthalene | 0.00016 | 0.000378 | 9.30 | 6.70 | 0.00730 | 0.00253 |
| 25 | Oil and Grease | 0.895 | 2.12 | 1.95 | 1.08 | 4.13 | 2.28 |
| **Finishing (Pickling)** | | | | | | | |
| Flow Factor = 3.09 $m^3$/tonne | | | | | | | |
| 8 | TSS | 33.8 | 105 | 2.39 | 1.23 | 250 | 129 |
| 9 | Total Lead | 0.138 | 0.426 | 4.73 | 1.91 | 2.01 | 0.814 |
| 9 | Total Zinc | 0.791 | 2.45 | 4.39 | 1.74 | 10.8 | 4.26 |
| 25 | Oil and Grease | 9.51 | 29.4 | 8.33 | 1.67 | 245 | 49.2 |

Note: Loadings shown in shaded areas are for parameters not generated by the process but included due to the usage of a centralized treatment plant.

# Table 5.4
## Effluent Loadings Limits (kg/day)
## Algoma Steel

| ATG | Parameter | Limit | Process Subcategories | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Coke | Iron | Steel | #1 C.C. | #2 C.C.& Hotform | #1&#2 TM | Finish | Total |
| 2 | Cyanide Total | Daily | 29.6 | 1.28 | - | - | 4.49 | - | 0.0473 | 35.4 |
| | | Monthly | 13.3 | 0.566 | - | - | 2.53 | - | 0.0266 | 16.4 |
| 4a | Ammonia+Ammonium | Daily | 101 | 137 | - | - | 366 | - | 3.86 | 608 |
| | | Monthly | 19.1 | 85.4 | - | - | 114 | - | 1.20 | 219 |
| 8 | TSS | Daily | 71.0 | 163 | 591 | 431 | 3050 | 1820 | 391 | 6520 |
| | | Monthly | 35.6 | 68.3 | 303 | 221 | 1030 | 524 | 197 | 2380 |
| 9 | Total Lead | Daily | 0.172 | 0.738 | 1.83 | 5.12 | 13.7 | - | 2.96 | 24.5 |
| | | Monthly | 0.0859 | 0.374 | 0.737 | 2.07 | 6.88 | - | 1.20 | 11.3 |
| 9 | Total Zinc | Daily | 0.0937 | 7.27 | 2.36 | 6.97 | 18.6 | - | 15.8 | 51.1 |
| | | Monthly | 0.0467 | 3.13 | 0.940 | 2.77 | 9.33 | - | 6.26 | 22.5 |
| 14 | Phenolics (4AAP) | Daily | 0.404 | 0.344 | - | - | 3.55 | - | 0.0374 | 4.34 |
| | | Monthly | 0.133 | 0.122 | - | - | 1.20 | - | 0.0127 | 1.45 |
| 17 | Benzene | Daily | 0.0955 | - | - | - | 0.318 | - | 0.00335 | 0.417 |
| | | Monthly | 0.0317 | - | - | - | 0.111 | - | 0.00116 | 0.143 |
| 19 | Benzo(a)pyrene | Daily | 0.0955 | - | - | - | 0.382 | - | 0.00402 | 0.481 |
| | | Monthly | 0.0317 | - | - | - | 0.133 | - | 0.00140 | 0.166 |
| 19 | Naphthalene | Daily | 0.0955 | - | - | - | 1.02 | - | 0.0107 | 1.12 |
| | | Monthly | 0.0317 | - | - | - | 0.354 | - | 0.00373 | 0.389 |
| 25 | Oil and Grease | Daily | 23.7 | 11.7 | - | 114 | 784 | 304 | 366 | 1600 |
| | | Monthly | 11.8 | 6.47 | - | 22.9 | 434 | 84.2 | 75.6 | 635 |

# Table 5.5
## Production-Based Loadings (g/tonne)
## Dofasco Inc.

<table>
<tr><th>ATG</th><th>Parameter</th><th>LTA Conc. (mg/L)</th><th>LTA g/tonne</th><th>VF (1)</th><th>VF(30) VF(4)</th><th>Daily Maximum g/tonne</th><th>Monthly Average g/tonne</th></tr>
<tr><td colspan="8"><b>Continuous Casting & Hot Forming & Vacuum Degassing</b></td></tr>
<tr><td colspan="8">Flow Factor = 0.837 m³/tonne</td></tr>
<tr><td>8</td><td>TSS</td><td>4.80</td><td>4.02</td><td>4.08</td><td>1.53</td><td>16.4</td><td>6.15</td></tr>
<tr><td>9</td><td>Total Lead</td><td>0.0489</td><td>0.041</td><td>11.7</td><td>3.38</td><td>0.479</td><td>0.138</td></tr>
<tr><td>9</td><td>Total Zinc</td><td>0.0326</td><td>0.0273</td><td>6.78</td><td>2.36</td><td>0.185</td><td>0.0645</td></tr>
<tr><td>25</td><td>Oil and Grease</td><td>4.50</td><td>3.77</td><td>5.00</td><td>2.50</td><td>18.8</td><td>9.42</td></tr>
<tr><td colspan="8"><b>#2 Hot Mill Filter Backwash*</b></td></tr>
<tr><td colspan="8">Flow = 4360 m³/day</td></tr>
<tr><td>ATG</td><td>Parameter</td><td>LTA Conc. (mg/L)</td><td>LTA (kg/day)</td><td>VF(1)</td><td>VF(30) VF(4)</td><td>Daily Limit (kg/day)</td><td>Monthly Average (kg/day)</td></tr>
<tr><td>8</td><td>TSS</td><td>20.0</td><td>87.2</td><td>6.56</td><td>1.78</td><td>572</td><td>155</td></tr>
<tr><td>9</td><td>Total Lead</td><td>0.0921</td><td>0.402</td><td>9.64</td><td>2.19</td><td>3.87</td><td>0.878</td></tr>
<tr><td>9</td><td>Total Zinc</td><td>0.218</td><td>0.951</td><td>12.4</td><td>2.37</td><td>11.8</td><td>2.26</td></tr>
<tr><td>25</td><td>Oil and Grease</td><td>4.50</td><td>19.6</td><td>10.0</td><td>1.39</td><td>196</td><td>27.3</td></tr>
<tr><td colspan="8"><b>#1 Acid Regeneration Plant*</b></td></tr>
<tr><td colspan="8">Flow = 13400 m³/day</td></tr>
<tr><td>ATG</td><td>Parameter</td><td>LTA Conc. (mg/L)</td><td>LTA (kg/day)</td><td>VF(1)</td><td>VF(30) VF(4)</td><td>Daily Limits (kg/day)</td><td>Monthly Average (kg/day)</td></tr>
<tr><td>8</td><td>TSS</td><td>9.80</td><td>131</td><td>4.08</td><td>1.53</td><td>536</td><td>201</td></tr>
<tr><td>9</td><td>Total Lead</td><td>0.00625</td><td>0.0838</td><td>11.7</td><td>3.38</td><td>0.980</td><td>0.400</td></tr>
<tr><td>9</td><td>Total Zinc</td><td>0.0144</td><td>0.193</td><td>6.78</td><td>2.36</td><td>1.31</td><td>0.455</td></tr>
<tr><td>25</td><td>Oil and Grease</td><td>2.00</td><td>26.8</td><td>5.00</td><td>2.50</td><td>134</td><td>67.0</td></tr>
</table>

* Note: The loadings from the #2 Hot Mill Filter Backwash and #1 Acid Regeneration Plant are independent of production.

## Table 5.6
## Effluent Loading Limits (kg/day)
## Dofasco Inc.

| ATG | Parameter | Limit | Process Subcategories | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | Coke | Iron | Steel | C.C. & HF & VD | #2 HM | #1 ARP | Total |
| 2 | Cyanide Total | Daily | 42.2 | 1.88 | - | - | - | - | 44.1 |
| | | Monthly | 19.0 | 0.829 | - | - | - | - | 19.8 |
| 4a | Ammonia+Ammonium | Daily | 144 | 200 | - | - | - | - | 344 |
| | | Monthly | 27.2 | 125 | - | - | - | - | 152 |
| 8 | TSS | Daily | 101 | 238 | 119 | 197 | 572 | 536 | 1760 |
| | | Monthly | 50.7 | 100 | 65.9 | 73.8 | 155 | 201 | 646 |
| 9 | Total Lead | Daily | 0.245 | 1.08 | 9.28 | 5.75 | 3.87 | 0.980 | 21.2 |
| | | Monthly | 0.122 | 0.548 | 2.47 | 1.66 | 0.878 | 0.400 | 6.08 |
| 9 | Total Zinc | Daily | 0.133 | 10.7 | 10.0 | 2.22 | 11.8 | 1.31 | 36.1 |
| | | Monthly | 0.0665 | 4.58 | 3.57 | 0.774 | 2.26 | 0.436 | 11.7 |
| 14 | Phenolics (4AAP) | Daily | 0.576 | 0.504 | - | - | - | - | 1.08 |
| | | Monthly | 0.160 | 0.204 | - | - | - | - | 0.364 |
| 17 | Benzene | Daily | 0.136 | - | - | - | - | - | 0.136 |
| | | Monthly | 0.0452 | - | - | - | - | - | 0.0452 |
| 19 | Benzo(a)pyrene | Daily | 0.136 | - | - | - | - | - | 0.136 |
| | | Monthly | 0.0452 | - | - | - | - | - | 0.0452 |
| 19 | Naphthalene | Daily | 0.136 | - | - | - | - | - | 0.136 |
| | | Monthly | 0.0452 | - | - | - | - | - | 0.0452 |
| 25 | Oil and Grease | Daily | 33.7 | - | - | 226 | 196 | 134 | 590 |
| | | Monthly | 16.8 | - | - | 113 | 27.3 | 67.0 | 224 |

# Table 5.7
# Production-Based Loadings (g/tonne)
# Stelco Hilton Works

| ATG | Parameter | LTA Conc. (mg/L) | LTA g/tonne | VF (1) | VF(30) VF(4) | Daily Maximum g/tonne | Monthly Average g/tonne |
|---|---|---|---|---|---|---|---|
| **Sintering (Post-MISA)** | | | | | | | |
| Flow Factor = 7.55 m³/tonne | | | | | | | |
| 8 | TSS | 1.70 | 12.8 | 5.55 | 1.44 | 71.2 | 18.4 |
| 9 | Total Lead | 0.0530 | 0.400 | 5.00 | 2.50 | 2.00 | 1.00 |
| 14 | Phenolics | 0.00490 | 0.037 | 5.32 | 1.93 | 0.197 | 0.0712 |
| 25 | Oil and Grease | 1.37 | 10.3 | 4.69 | 1.21 | 48.3 | 12.4 |
| **Ironmaking (Post-MISA)** | | | | | | | |
| Flow Factor = 1.71 m³/tonne | | | | | | | |
| 2 | Cyanide Total | 0.0471 | 0.0806 | 2.85 | 1.45 | 0.229 | 0.117 |
| 4a | Ammonia | 6.86 | 11.7 | 4.35 | 1.83 | 51.1 | 21.4 |
| 8 | TSS | 5.32 | 9.09 | 5.55 | 1.44 | 50.5 | 13.0 |
| 9 | Total Lead | 0.0429 | 0.0733 | 5.00 | 2.50 | 0.367 | 0.183 |
| 9 | Total Zinc | 0.156 | 0.267 | 4.29 | 1.56 | 1.14 | 0.416 |
| 9 | Total Chromium | 0.0112 | 0.0192 | 5.67 | 1.66 | 0.109 | 0.0318 |
| 14 | Phenolics | 0.00336 | 0.00575 | 5.32 | 1.93 | 0.0306 | 0.0111 |
| 17 | Benzene | 0.000052 | 0.000089 | 19.3 | 6.70 | 0.00172 | 0.000596 |
| 19 | Benzo(a)pyrene | 0.000063 | 0.000107 | 19.3 | 6.70 | 0.00206 | 0.000716 |
| 19 | Naphthalene | 0.000167 | 0.000285 | 19.3 | 6.70 | 0.00549 | 0.00191 |
| 25 | Oil and Grease | 1.32 | 2.26 | 4.69 | 1.21 | 10.6 | 2.73 |

Note: Loadings shown in shaded areas are for parameters not generated by the process but included due to the usage of a centralized treatment system.

# Table 5.7
# Production-Based Loadings (g/tonne)
# Stelco Hilton Works

| ATG | Parameter | LTA Conc. (mg/L) | LTA g/tonne | VF (1) | VF(30) VF(4) | Daily Maximum g/tonne | Monthly Average g/tonne |
|---|---|---|---|---|---|---|---|
| **Continuous Casting** | | | | | | | |
| Flow Factor = 5.99 m³/tonne | | | | | | | |
| 2 | Cyanide Total | 0.00633 | 0.0379 | 2.85 | 1.45 | 0.108 | 0.0550 |
| 4a | Ammonia | 0.495 | 2.96 | 4.35 | 1.83 | 12.9 | 5.41 |
| 8 | TSS | 4.20 | 25.2 | 5.55 | 1.44 | 140 | 36.1 |
| 9 | Total Lead | 0.00135 | 0.00805 | 5.00 | 2.50 | 0.0403 | 0.0201 |
| 9 | Total Zinc | 0.0326 | 0.195 | 4.29 | 1.56 | 0.835 | 0.304 |
| 9 | Total Chromium | 0.0108 | 0.0646 | 5.67 | 1.66 | 0.366 | 0.107 |
| 14 | Phenolics | 0.00144 | 0.00860 | 5.32 | 1.93 | 0.0458 | 0.0166 |
| 17 | Benzene | 0.00005 | 0.000299 | 19.3 | 6.70 | 0.00577 | 0.00201 |
| 19 | Benzo(a)pyrene | 0.00006 | 0.000359 | 19.3 | 6.70 | 0.00693 | 0.00241 |
| 19 | Naphthalene | 0.00016 | 0.000958 | 19.3 | 6.70 | 0.0185 | 0.00642 |
| 25 | Oil and Grease | 1.38 | 8.27 | 4.69 | 1.21 | 38.8 | 9.98 |
| **Hot Forming** | | | | | | | |
| Flow Factor = 31.7 m³/tonne | | | | | | | |
| 2 | Cyanide Total | 0.00633 | 0.201 | 2.85 | 1.45 | 0.572 | 0.292 |
| 4a | Ammonia+Ammonium | 0.495 | 15.7 | 4.35 | 1.83 | 68.3 | 28.7 |
| 8 | TSS | 8.71 | 276 | 5.55 | 1.44 | 1530 | 397 |
| 9 | Total Lead | 0.00311 | 0.0986 | 5.00 | 2.50 | 0.493 | 0.246 |
| 9 | Total Zinc | 0.0336 | 1.06 | 4.29 | 1.56 | 4.56 | 1.66 |
| 9 | Total Chromium | 0.0108 | 0.342 | 5.67 | 1.66 | 1.94 | 0.567 |
| 14 | Phenolics (4AAP) | 0.00144 | 0.0456 | 5.32 | 1.93 | 0.243 | 0.0878 |
| 17 | Benzene | 0.00005 | 0.00159 | 19.3 | 6.70 | 0.0306 | 0.0106 |
| 19 | Benzo(a)pyrene | 0.00006 | 0.00190 | 19.3 | 6.70 | 0.0367 | 0.0127 |
| 19 | Naphthalene | 0.00016 | 0.00507 | 19.3 | 6.70 | 0.0979 | 0.0340 |
| 25 | Oil and Grease | 2.54 | 80.6 | 4.69 | 1.21 | 378 | 97.3 |

Note: Loadings shown in shaded areas are for parameters not generated by the process but included due to the usage of a centralized treatment system.

# Table 5.7
# Production-Based Loadings (g/tonne)
# Stelco Hilton Works

| ATG | Parameter | LTA Conc. (mg/L) | LTA g/tonne | VF (1) | VF(30) VF(4) | Daily Maximum g/tonne | Monthly Average g/tonne |
|---|---|---|---|---|---|---|---|
| **#3 Bloom & Billet** | | | | | | | |
| Flow Factor = 22.6 m³/tonne | | | | | | | |
| 2 | TSS | 10.9 | 246 | 4.08 | 1.53 | 1000 | 377 |
| 25 | Oil and Grease | 1.62 | 36.6 | 6.19 | 2.50 | 226 | 91.5 |
| **Finishing Operations** | | | | | | | |
| Flow Factor = 9.19 m³/tonne | | | | | | | |
| 2 | Cyanide Total | 0.00633 | 0.0582 | 2.85 | 1.45 | 0.166 | 0.0845 |
| 4a | Ammonia | 0.495 | 4.55 | 4.35 | 1.83 | 19.8 | 8.31 |
| 8 | TSS | 8.71 | 80.1 | 5.55 | 1.44 | 445 | 115 |
| 9 | Total Lead | 0.0407 | 0.374 | 5.00 | 2.50 | 1.87 | 0.936 |
| 9 | Total Zinc | 0.299 | 2.75 | 4.29 | 1.56 | 11.8 | 4.29 |
| 9 | Total Chromium | 0.0269 | 0.247 | 5.67 | 1.66 | 1.40 | 0.410 |
| 14 | Phenolics | 0.00144 | 0.0132 | 5.32 | 1.93 | 0.0703 | 0.0254 |
| 17 | Benzene | 0.00005 | 0.000460 | 19.3 | 6.70 | 0.00886 | 0.00308 |
| 19 | Benzo(a)pyrene | 0.00006 | 0.000552 | 19.3 | 6.70 | 0.0106 | 0.00370 |
| 19 | Naphthalene | 0.00016 | 0.00147 | 19.3 | 6.70 | 0.0284 | 0.00985 |
| 25 | Oil and Grease | 2.54 | 23.4 | 4.69 | 1.21 | 109 | 28.2 |

Note: Loadings shown in shaded areas are for parameters not generated by the process but included due to the usage of a centralized treatment system.

# Table 5.8
# Cooling Water Allowances (kg/day)
# Stelco Hilton Works

| ATG | Parameter | LTA Conc. (mg/L) | LTA (kg/day) | VF (1) | VF(30) VF(4) | Daily Maximum Limit (kg/day) | Monthly Average Limit (kg/day) |
|---|---|---|---|---|---|---|---|
| **Hot Forming** | | | | | | | |
| Flow = 129000 m³/day | | | | | | | |
| 2 | Cyanide Total | 0.00633 | 0.818 | 2.85 | 1.45 | 2.33 | 1.19 |
| 4a | Ammonia | 0.495 | 64.0 | 4.35 | 1.83 | 278 | 117 |
| 8 | TSS | 3.36 | 434 | 5.55 | 1.44 | 2410 | 622 |
| 9 | Total Lead | 0.00311 | 0.402 | 5.00 | 2.50 | 2.01 | 1.00 |
| 9 | Total Zinc | 0.0336 | 4.34 | 4.29 | 1.56 | 18.6 | 6.77 |
| 9 | Total Chromium | 0.0108 | 1.40 | 5.67 | 1.66 | 7.91 | 2.31 |
| 14 | Phenolics | 0.00144 | 0.186 | 5.32 | 1.93 | 0.989 | 0.358 |
| 17 | Benzene | 0.00005 | 0.00646 | 19.3 | 6.70 | 0.125 | 0.0433 |
| 19 | Benzo(a)pyrene | 0.00006 | 0.00776 | 19.3 | 6.70 | 0.150 | 0.0520 |
| 19 | Naphthalene | 0.00016 | 0.0207 | 19.3 | 6.70 | 0.399 | 0.139 |
| 25 | Oil and Grease | 1.33 | 172 | 4.69 | 1.21 | 806 | 208 |
| **Finishing** | | | | | | | |
| Flow = 27800 m³/day | | | | | | | |
| 2 | Cyanide Total | 0.00633 | 0.176 | 2.85 | 1.45 | 0.500 | 0.255 |
| 4a | Ammonia | 0.495 | 13.7 | 4.35 | 1.83 | 59.8 | 25.1 |
| 8 | TSS | 3.36 | 93.1 | 5.55 | 1.44 | 517 | 134 |
| 9 | Total Lead | 0.00311 | 0.0865 | 5.00 | 2.50 | 0.432 | 0.216 |
| 9 | Total Zinc | 0.0336 | 0.932 | 4.29 | 1.56 | 0.279 | 0.129 |
| 9 | Total Chromium | 0.0108 | 0.300 | 5.67 | 1.66 | 1.70 | 0.496 |
| 14 | Phenolics | 0.00144 | 0.0399 | 5.32 | 1.93 | 0.212 | 0.0769 |
| 17 | Benzene | 0.00005 | 0.00139 | 19.3 | 6.70 | 0.0268 | 0.00930 |
| 19 | Benzo(a)pyrene | 0.00006 | 0.00167 | 19.3 | 6.70 | 0.0321 | 0.0112 |
| 19 | Naphthalene | 0.00016 | 0.00444 | 19.3 | 6.70 | 0.0857 | 0.0298 |
| 25 | Oil and Grease | 1.33 | 37.0 | 4.69 | 1.21 | 173 | 44.7 |

Note: Cooling water loadings are independent of production rate.

# Table 5.9
## Effluent Loading Limits (kg/day)
## Stelco Hilton Works

| ATG | Parameter | Limit | Process Subcategories | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Coke | Iron | Sinter | Concast | Hot Form | #3 B&B | Finish | Total |
| 2 | Cyanide Total | Daily | 44.5 | 1.97 | - | 0.933 | 8.14 | - | 1.64 | 57.3 |
| | | Monthly | 20.0 | 1.01 | - | 0.506 | 4.15 | - | 0.838 | 26.5 |
| 4a | Ammonia+Ammonium | Daily | 152 | 439 | - | 119 | 973 | - | 196 | 1880 |
| | | Monthly | 28.7 | 184 | - | 49.8 | 408 | - | 82.5 | 754 |
| 8 | TSS | Daily | 107 | 434 | 128 | 1290 | 18000 | 3720 | 3590 | 27300 |
| | | Monthly | 53.6 | 112 | 33.1 | 332 | 4650 | 1390 | 927 | 7500 |
| 9 | Total Lead | Daily | 0.258 | 3.15 | 3.60 | 0.370 | 7.02 | - | 13.3 | 27.7 |
| | | Monthly | 0.129 | 1.58 | 1.80 | 0.185 | 3.51 | - | 6.67 | 13.9 |
| 9 | Total Zinc | Daily | 0.141 | 9.83 | - | 7.69 | 65.0 | - | 85.4 | 168 |
| | | Monthly | 0.0702 | 3.58 | - | 2.80 | 23.6 | - | 31.1 | 61.1 |
| 9 | Total Chromium | Daily | - | 0.584 | - | 3.37 | 27.6 | - | 11.4 | 42.9 |
| | | Monthly | - | 0.171 | - | 0.985 | 8.08 | - | 3.32 | 12.6 |
| 14 | Phenolics (4AAP) | Daily | 0.608 | 0.263 | 0.354 | 0.421 | 3.45 | - | 0.698 | 5.80 |
| | | Monthly | 0.169 | 0.0953 | 0.128 | 0.152 | 1.25 | - | 0.252 | 2.05 |
| 17 | Benzene | Daily | 0.144 | 0.00920 | - | 0.0531 | 0.435 | - | 0.0879 | 0.729 |
| | | Monthly | 0.0477 | 0.00320 | - | 0.0184 | 0.151 | - | 0.0305 | 0.251 |
| 19 | Benzo(a)pyrene | Daily | 0.144 | 0.0110 | - | 0.0637 | 0.523 | - | 0.106 | 0.846 |
| | | Monthly | 0.0477 | 0.00383 | - | 0.0221 | 0.182 | - | 0.0367 | 0.292 |
| 19 | Naphthalene | Daily | 0.144 | 0.0294 | - | 0.170 | 1.39 | - | 0.281 | 2.02 |
| | | Monthly | 0.0477 | 0.0102 | - | 0.0590 | 0.484 | - | 0.0977 | 0.699 |
| 25 | Oil and Grease | Daily | 35.6 | 56.8 | 87.0 | 357 | 4640 | 837 | 929 | 6950 |
| | | Monthly | 17.8 | 14.6 | 22.4 | 91.8 | 1200 | 338 | 239 | 1920 |

## Table 5.10
## Production-Based Loadings (g/tonne)
## Stelco Hilton Works - #2 Rod Mill

| ATG | Parameter | LTA Conc. (mg/L) | LTA g/tonne | VF (1) | VF(30)<br>VF(4) | Daily Maximum g/tonne | Monthly Average g/tonne |
|---|---|---|---|---|---|---|---|
| Flow Factor = 21.8 m³/tonne | | | | | | | |
| 8 | TSS | 5.69 | 124 | 4.73 | 1.28 | 586 | 158 |
| 25 | O & G | 1.36 | 29.6 | 3.23 | 1.28 | 95.6 | 38.0 |

## Table 5.11
## Effluent Loading Limits (kg/day)
## Stelco Hilton Works - #2 Rod Mill

| ATG | Parameter | Daily Maximum Limit | Monthly Average Limit |
|---|---|---|---|
| 8 | TSS | 1600 | 431 |
| 25 | O & G | 261 | 103 |

# Table 5.12
# Production-Based Loadings (g/tonne)
# Stelco Lake Erie Works

| ATG | Parameter | LTA Conc. (mg/L) | LTA g/tonne | VF (1) | VF(30)<br>VF(4) | Daily Maximum g/tonne | Monthly Average g/tonne |
|---|---|---|---|---|---|---|---|
| **Cokemaking** | | | | | | | |
| Flow Factor = 0.60 m$^3$/tonne | | | | | | | |
| 2 | Cyanide Total | 0.583 | 0.350 | 7.71 | 3.06 | 2.70 | 1.07 |
| 4a | Ammonia + Ammonium | 0.432 | 0.259 | 8.73 | 3.95 | 2.26 | 1.02 |
| 8 | TSS | 4.87 | 2.92 | 4.11 | 1.70 | 12.0 | 4.97 |
| 14 | Phenolics (4AAP) | 0.0123 | 0.00738 | 5.20 | 2.60 | 0.0384 | 0.0192 |
| 17 | Benzene | 0.0118 | 0.00708 | 4.51 | 1.50 | 0.0319 | 0.0106 |
| 19 | Benzo(a)pyrene | 0.0118 | 0.00708 | 4.51 | 1.50 | 0.0319 | 0.0106 |
| 19 | Naphthalene | 0.0118 | 0.00708 | 4.51 | 1.50 | 0.0319 | 0.0106 |
| 25 | Oil and Grease | 2.50 | 1.50 | 2.00 | 1.20 | 3.00 | 1.80 |
| **Ironmaking** | | | | | | | |
| Flow Factor= 0.80 m$^3$/tonne | | | | | | | |
| 2 | Cyanide Total | 0.581 | 0.465 | 7.70 | 3.05 | 3.58 | 1.42 |
| 4a | Ammonia + Ammonium | 0.430 | 0.344 | 8.72 | 3.95 | 3.00 | 1.36 |
| 8 | TSS | 4.85 | 3.88 | 4.10 | 1.70 | 15.9 | 6.60 |
| 9 | Total Lead | 0.0439 | 0.0351 | 13.6 | 4.53 | 0.478 | 0.159 |
| 9 | Total Zinc | 0.0884 | 0.0707 | 10.1 | 3.38 | 0.717 | 0.239 |
| 14 | Phenolics (4AAP) | 0.0112 | 0.00979 | 5.20 | 2.60 | 0.0509 | 0.0255 |
| **Steelmaking** | | | | | | | |
| Flow Factor= 1.25 m$^3$/tonne* | | | | | | | |
| 8 | TSS | 4.87 | 6.09 | 4.11 | 1.70 | 25.0 | 10.4 |
| 9 | Total Lead | 0.0440 | 0.055 | 13.6 | 4.55 | 0.749 | 0.25 |
| 9 | Total Zinc | 0.0888 | 0.111 | 10.1 | 3.38 | 1.12 | 0.375 |

* The flow factor includes flow from the Secondary Exchange Cooling Water

# Table 5.12
# Production-Based Loadings (g/tonne)
# Stelco Lake Erie Works

| ATG | Parameter | LTA Conc. (mg/L) | LTA g/tonne | VF (1) | VF(30) VF(4) | Daily Maximum g/tonne | Monthly Average g/tonne |
|---|---|---|---|---|---|---|---|
| **Vacuum Degassing** | | | | | | | |
| Flow Factor = 0.114 $m^3$/tonne | | | | | | | |
| 8 | TSS | 4.86 | 0.554 | 4.10 | 1.70 | 2.27 | 0.942 |
| 9 | Total Lead | 0.0439 | 0.00500 | 13.6 | 4.54 | 0.0681 | 0.0227 |
| 9 | Total Zinc | 0.0886 | 0.0101 | 10.1 | 3.38 | 0.102 | 0.0341 |
| **Continuous Casting** | | | | | | | |
| Flow Factor= 1.36 $m^3$/tonne | | | | | | | |
| 8 | TSS | 4.89 | 6.65 | 4.11 | 1.70 | 27.3 | 11.3 |
| 9 | Total Lead | 0.0442 | 0.0601 | 13.6 | 4.54 | 0.819 | 0.273 |
| 9 | Total Zinc | 0.0890 | 0.121 | 10.2 | 3.38 | 1.23 | 0.409 |
| 25 | Oil and Grease | | 3.42 | 3.98 | 1.99 | 13.6 | 6.82 |
| **Hot Forming** | | | | | | | |
| Flow Factor= 1.25 $m^3$/tonne* | | | | | | | |
| 8 | TSS | 4.88 | 6.24 | 4.10 | 1.70 | 25.6 | 10.6 |
| 25 | Oil and Grease | 2.50 | 3.20 | 4.00 | 2.00 | 12.8 | 6.40 |

* The flow factor includes the blowdown from the Central Power Station

## Table 5.13
## Effluent Loading Limits (kg/day)
## Stelco Lake Erie Works

| ATG | Parameter | Limit | Process Subcategories | | | | | | | U.S.EPA NSPS |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Coke | Iron | Steel | Vacuum Degassing | Concast | Hot Form | Total | |
| 2 | Cyanide Total | Daily | 4.68 | 21.3 | - | - | - | - | 26.0 | 14.5 |
| | | Monthly | 1.86 | 8.46 | - | - | - | - | 10.3 | 7.33 |
| 4a | Ammonia+Ammonium | Daily | 3.92 | 17.9 | - | - | - | - | 21.8 | 146 |
| | | Monthly | 1.77 | 8.11 | - | - | - | - | 9.88 | 41.2 |
| 8 | TSS | Daily | 20.8 | 94.8 | 170 | 15.4 | 186 | 192 | 679 | 1010 |
| | | Monthly | 8.62 | 39.3 | 70.4 | 6.41 | 76.9 | 79.6 | 281 | 366 |
| 9 | Total Lead | Daily | - | 2.85 | 5.09 | 0.463 | 5.57 | - | 14.0 | 5.65 |
| | | Monthly | - | 0.948 | 1.70 | 0.154 | 1.86 | - | 4.65 | 1.55 |
| 9 | Total Zinc | Daily | - | 4.27 | 7.62 | 0.694 | 8.36 | - | 20.9 | 8.48 |
| | | Monthly | - | 1.42 | 2.55 | 0.232 | 2.78 | - | 6.99 | 2.33 |
| 14 | Phenolics (4AAP) | Daily | 0.0666 | 0.303 | - | - | - | - | 0.370 | 0.459 |
| | | Monthly | 0.0333 | 0.152 | - | - | - | - | 0.185 | 0.197 |
| 17 | Benzene | Daily | 0.0553 | - | - | - | - | - | 0.0533 | 0.0553 |
| | | Monthly | 0.0184 | - | - | - | - | - | 0.0184 | - |
| 19 | Benzo(a)pyrene | Daily | 0.0553 | - | - | - | - | - | 0.0553 | 0.0553 |
| | | Monthly | 0.0184 | - | - | - | - | - | 0.0184 | - |
| 19 | Naphthalene | Daily | 0.0553 | - | - | - | - | - | 0.0553 | 0.0553 |
| | | Monthly | 0.0184 | - | - | - | - | - | 0.0184 | - |
| 25 | Oil and Grease | Daily | 5.20 | - | - | - | 92.5 | 96.0 | 194 | 131 |
| | | Monthly | 3.12 | - | - | - | 46.4 | 48.0 | 97.5 | - |

# Table 5.14
# Production-Based Loadings (g/tonne)
# Atlas Specialty Steels

| ATG | Parameter | LTA Conc. (mg/L) | LTA g/tonne | VF (1) | VF(30) VF(4) | Daily Maximum g/tonne | Monthly Average g/tonne |
|---|---|---|---|---|---|---|---|
| **Vacuum Oxygen Refining** | | | | | | | |
| Flow Factor = 1.40 $m^3$/tonne | | | | | | | |
| 8 | TSS | 3.71 | 5.19 | 5.53 | 1.77 | 28.7 | 9.16 |
| 9 | Total Chromium | 0.0270 | 0.0378 | 7.39 | 2.09 | 0.279 | 0.079 |
| 9 | Total Nickel | 0.122 | 0.171 | 10.2 | 3.22 | 1.74 | 0.550 |
| 9 | Total Zinc | 0.0900 | 0.126 | 10.2 | 2.08 | 1.28 | 0.262 |
| 25 | Oil and Grease | 1.81 | 2.54 | 7.91 | 1.75 | 20.1 | 4.45 |
| **Continuous Casting** | | | | | | | |
| Flow Factor= 1.40 $m^3$/tonne | | | | | | | |
| 8 | TSS | 3.71 | 5.19 | 5.53 | 1.77 | 28.7 | 9.16 |
| 9 | Total Chromium | 0.0270 | 0.0378 | 7.39 | 2.09 | 0.279 | 0.079 |
| 9 | Total Nickel | 0.122 | 0.171 | 10.2 | 3.22 | 1.74 | 0.550 |
| 9 | Total Zinc | 0.0900 | 0.126 | 10.2 | 2.08 | 1.28 | 0.262 |
| 25 | Oil and Grease | 1.81 | 2.54 | 7.91 | 1.75 | 20.1 | 4.45 |
| **Hot Forming** | | | | | | | |
| Flow Factor= 5.78 $m^3$/tonne | | | | | | | |
| 8 | TSS | 3.71 | 21.4 | 5.53 | 1.77 | 118 | 37.8 |
| 9 | Total Chromium | 0.0270 | 0.156 | 7.39 | 2.09 | 1.15 | 0.326 |
| 9 | Total Nickel | 0.122 | 0.705 | 10.2 | 3.22 | 7.18 | 2.27 |
| 9 | Total Zinc | 0.0900 | 0.520 | 10.2 | 2.08 | 5.30 | 1.08 |
| 25 | Oil and Grease | 1.81 | 10.5 | 7.91 | 1.75 | 82.9 | 18.3 |

## Table 5.15
## Effluent Loadings Limits (kg/day)
## Atlas Specialty Steels

| | | | Process Subcategories | | | | |
|---|---|---|---|---|---|---|---|
| **ATG** | **Parameter** | **Limit** | **VOD** | **Concast** | **Hot Form** | **Forge** | **Total** |
| 8 | TSS | Daily | 19.5 | 12.3 | 50.6 | 13.4 | 95.8 |
| | | Monthly | 6.23 | 3.91 | 16.1 | 4.29 | 30.6 |
| 9 | Total Chromium | Daily | 0.190 | 0.119 | 0.492 | - | 0.801 |
| | | Monthly | 0.0537 | 0.0337 | 0.139 | - | 0.227 |
| 9 | Total Nickel | Daily | 1.18 | 0.743 | 3.07 | - | 4.99 |
| | | Monthly | 0.374 | 0.235 | 0.968 | - | 1.58 |
| 9 | Total Zinc | Daily | 0.873 | 0.548 | 2.26 | - | 3.68 |
| | | Monthly | 0.178 | 0.112 | 0.461 | - | 0.751 |
| 25 | Oil and Grease | Daily | 13.7 | 8.58 | 35.4 | - | 57.6 |
| | | Monthly | 3.02 | 1.90 | 7.83 | - | 12.8 |

## Table 5.16
## Production-Based Loadings (g/tonne)
## Mini-Mills

| ATG | Parameter | LTA Conc. (mg/L) | LTA g/tonne | VF (1) | VF(30) VF(4) | Daily Maximum g/tonne | Monthly Average g/tonne |
|---|---|---|---|---|---|---|---|
| Flow Factor = 0.85 $m^3$/tonne | | | | | | | |
| 8 | TSS | 9.80 | 8.33 | 4.08 | 1.53 | 34.0 | 12.7 |
| 9 | Total Lead | 0.0300 | 0.0255 | 11.7 | 3.38 | 0.299 | 0.0861 |
| 9 | Total Zinc | 0.0640 | 0.0544 | 6.78 | 2.37 | 0.369 | 0.129 |
| 25 | Oil and Grease | 2.00 | 1.70 | 5.00 | 2.50 | 8.50 | 4.25 |

## Table 5.17
## Effluent Loading Limits (kg/day)
## Lake Ontario Steel Company

| ATG | Parameter | Daily Maximum | Monthly Average |
|---|---|---|---|
| 8 | TSS | 130 | 48.7 |
| 9 | Total Lead | 1.14 | 0.329 |
| 9 | Total Zinc | 1.41 | 0.492 |
| 25 | Oil and Grease | 32.5 | 16.2 |

## Table 5.18
## Effluent Loading Limits (kg/day)
## IVACO Rolling Mills

| ATG | Parameter | Daily Maximum | Monthly Average |
|---|---|---|---|
| 8 | TSS | 74.0 | 27.7 |
| 9 | Total Lead | 0.508 | 0.146 |
| 9 | Total Zinc | 0.628 | 0.219 |
| 25 | Oil and Grease | 18.5 | 9.25 |

## Table 5.19
## Effluent Requirements

| **Plant** | **ATG** | **Parameter** | **Limits (kg/day)** |
|---|---|---|---|
| Algoma Steel Inc. | 8 | TSS | 7355 |
| | 14 | Phenolics (4AAP) | 22.7 |
| | 25 | Oil & Grease | 1589 |
| Stelco Lake Erie Works | | Cyanide (Free) | 3.77 |
| | | Free Chlorine | 18.85 |
| | | Glycol | 346.84 |
| | 4a | Ammonia plus Ammonium | 35.82 |
| | 6 | Total Phosphorus | 37.70 |
| | 8 | TSS | 565.50 |
| | 9 | Chromium | 9.43 |
| | 9 | Copper | 4.15 |
| | 9 | Lead | 15.08 |
| | 9 | Zinc | 22.62 |
| | 14 | Phenolics (4AAP) | 0.75 |
| | 25 | Oil and Grease | 237.51 |
| | IS1 | Iron | 56.55 |

## Table 5.20
## Comparison of Ontario Limits With Other Jurisdictions Monthly Average Concentration Limits (mg/L)

| ATG | Parameter | Integrated Steel Mills Final Discharge | | | | Mini Steel Mills Final Discharge | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Ontario* | Korea | Japan | Taiwan | Ontario** | Saskatchewan | Nova Scotia | Quebec |
| 2 | Cyanide Total | 0.06 | - | 1.0 | 1.0 | - | - | - | - |
| 4a | Ammonia | 1.70 | - | - | - | - | - | - | - |
| 8 | TSS | 14.0 | 100 | 70 | - | 15 | 15 - 30 | 25.0 | 30 |
| 9 | Total Lead | 0.03 | 0.10 | 1.0 | 1.0 | 0.10 | - | 0.5 | 0.1 |
| 9 | Total Zinc | 0.14 | - | 1.0 | 1.0 | 0.15 | - | 0.5 | 0.1 |
| 9 | Total Nickel | - | - | 1.0 | 1.0 | 0.25 | - | - | - |
| 9 | Total Chromium | 0.03 | 0.05 | 2.0 | 2.0 | 0.04 | - | 0.05 | - |
| 14 | Phenolics | 0.005 | - | 0.5 | 5.0 | - | - | - | - |
| 25 | Oil & Grease | 15.0 | - | - | - | 15 | 15 - 30 | 10.0 | 30 |

Note: * Based on the proposed loading limits for the Stelco Hilton Works
** Based on the proposed loading limits for the mini-mills and specialty steel mill

## Table 5.21
## Comparison of Ontario Limits With U.S.EPA Production-Based Monthly Average Loading Limits (g/tonne)

| ATG | Parameter | Cokemaking | | Ironmaking | | Steelmaking | | Continuous Casting | | Hotforming | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Ontario | U.S. EPA | Ontario | U.S. EPA | Ontario | U.S. EPA | Ontario | U.S. EPA | Ontario | U.S. EPA |
| 2 | Cyanide Total | 4.45 | 3.51 | 0.0880 | 0.876 | - | - | - | - | - | - |
| 4a | Ammonia | 6.38 | 16.0 | 13.3 | 2.92* | - | - | - | - | - | - |
| 8 | TSS | 11.9 | 131 | 10.6 | 26.0 | 7.28 | 10.4 | 6.1-60 | 26.0 | 10-397 | 160 |
| 9 | Total Lead | - | - | 0.058 | 0.088 | 0.273 | 0.063 | 0.02-0.40 | 0.030 | - | - |
| 9 | Total Zinc | - | - | 0.486 | 0.131 | 0.394 | 0.094 | 0.06-0.55 | 0.047 | - | - |
| 14 | Phenolics | 0.038 | 0.032 | 0.022 | 0.029 | - | - | - | - | - | - |
| 17 | Benzene | 0.011 | 0.032 | - | - | - | - | - | - | - | - |
| 19 | Benzo(a)pyrene | 0.011 | 0.032 | - | - | - | - | - | - | - | - |
| 19 | Naphthalene | 0.011 | 0.032 | - | - | - | - | - | - | - | - |
| 25 | Oil & Grease | 3.95 | 10.9 | - | - | - | - | 6.8-25.4 | 7.8 | 6-97 | 107 |

Note: * The US steel plants have been granted a variance from the ammonia limitation.

## Table 5.22
## Cokemaking Process Subcategory
## Comparison of Ontario Limits With Overseas Jurisdictions
## Monthly Average Limits

| ATG | Parameter | Ontario | | Sweden | | Germany | |
|---|---|---|---|---|---|---|---|
| | | mg/L | g/tonne | mg/L | g/tonne | mg/L | g/tonne |
| 2 | Cyanide | 5.64 | 4.45 | 1.0 | - | 0.1 | - |
| 4a | Ammonia | 8.08 | 6.38 | 100 | - | 80 | - |
| 8 | TSS | 15.0 | 11.9 | - | 20.0 | 50 | - |
| 14 | Phenolics | 0.048 | 0.038 | 1.0 | 0.05 | 0.5 | - |
| | PAHs | 0.013 | 0.011 | - | 0.2 | Not Limited | Not Limited |

## Table 5.23
## Loading Reductions (kg/yr)
## Iron and Steel Sector

| ATG | Parameter | MISA Loading | BAT Loading | Loading Reduction | Percent Reduction |
|---|---|---|---|---|---|
| 2 | Cyanide | 89,920 | 15,601 | 74,319 | 83 |
| 4a | Ammonia | 968,101 | 178,016 | 790,085 | 82 |
| 8 | TSS | 4,410,743 | 1,818,303 | 2,592,440 | 59 |
| 9 | Lead | 6952 | 3842 | 3110 | 45 |
| 9 | Zinc | 34,433 | 14,560 | 19,873 | 58 |
| 9 | Chromium | 2,008 | 1,952 | 56 | 3 |
| 9 | Nickel | 668 | 249 | 419 | 63 |
| 14 | Phenolics | 17,682 | 590 | 17,902 | 97 |
| 17 | Benzene | 1,830 | 39 | 1,791 | 98 |
| 19 | Benzo(a)pyrene | 159 | 41 | 118 | 74 |
| 19 | Naphthalene | 199 | 67 | 132 | 66 |
| 25 | Oil and Grease | 623,681 | 522,622 | 101,059 | 16 |

# Chapter 6
# The Effluent Limits Regulation

## 6.1 Introduction

The Effluent Monitoring and Effluent Limits Regulation for the Iron and Steel Manufacturing Sector, made under the Environmental Protection Act of the Province of Ontario (Appendix V) has the following major compliance requirements:

- Loading limits for 12 parameters
- Non-acutely lethal effluents
- pH values for all process effluents are in the range of 6.0 to 9.5
- Prohibition of by-passes
- Compliance with the monitoring requirements for cooling water, chronic toxicity testing and conducting storm water control studies; and
- Reporting and record keeping

The requirements to meet the loading limits and lethality limits come into force on April 13, 1998.

The requirements to monitor begin on July 12, 1995.

## 6.2 Part I - General

Section 1 - Interpretation

This section does not redefine terms which are already defined in the Environmental Protection Act under which the Iron and Steel Regulation is written.

Section 1 provides:

- Clarification of the terms used in the Regulation which may have several possible interpretations;
- Definitions of the technical terms used in the Regulation which may not be in common usage;

- Definitions of the terms used in the Regulations which may have meanings different than those found in a dictionary or through common use;
- Definitions of the terms used in the Regulation which are specific to the Iron and Steel Sector;

Section 2 - Purpose

The purpose of the Regulation is to control the quantity of contaminants discharged to watercourses by the Sector plants.

This purpose is accomplished by:

- Loading limits for 12 parameters
- Non-acutely lethal effluents
- pH values for all process effluents are in the range of 6.0 to 9.5
- Prohibition of by-passes

Section 3 - Application

The Regulation only applies to the seven direct discharge Iron and Steel plants listed in Schedule 1 of the Regulation.

Section 4 - Obligations Under Approvals, Orders, etc.

The Regulation requires that plants in Schedule 1 shall also comply with any other obligations under Certificates of Approval, Control Orders, Directions or other instruments issued under any Act.

Section 5 - Non-Application of the General Effluent Monitoring Regulation

The General Effluent Monitoring Regulation (O. Regulation 695/88) is not applicable with the filing of this Regulation.

Section 6 - By-passes

By April 13, 1998 all by-passes are prohibited under the Regulation. All process effluent must be discharged through the designated sampling point.

Section 7 - Sampling and Analytical Procedures

The Regulation requires the discharger to follow the procedures for sampling and analysis which are documented in the Protocol for the Sampling and Analysis[15].

The Protocol outlines how the sample should be collected and analyzed and the analytical method detection level that the laboratory must achieve when analyzing the sample.

## 6.3 Part II - Sampling Points

Section 8 - Sampling Points To Be Used

Each discharger shall establish the sampling points to be used as designated in the discharger specific schedules by July 12, 1995.

A sampling point may be replaced or eliminated If the Director is satisfied, on the basis of written submissions from a discharger within thirty days of the change, that:

i. A process change or redirection of or change in the character of an effluent stream has occurred or is expected to occur at the discharger's plant.

ii. Sampling/flow equipments used are damaged or non-functional.

iii. The effluent stream has been or is expected to be permanently eliminated.

Section 9 - Report on Sampling Points

By July 24, 1995, the discharger shall submit a list and plot plans showing the sampling points.

When a sampling point is replaced, the discharger shall submit to the Director a written notice within 30 days after replacing a sampling point describing the location of the replacement sampling point, together with a revised list and plot plan showing the replacement sampling point.

When a sampling point is eliminated, the discharger shall submit to the Director a written notice within 30 days after the day on which a sampling point is eliminated, describing where the sampling point used to be, together with a revised list and plot plan without the sampling point.

Section 10 - Use of sampling points Established under Part II

Each discharger shall use the sampling points established under this part.

## 6.4 Part III - Calculation of Loadings

Sections 11, 12, 13, 14 and 15 - Calculation of Loadings and Concentrations

In calculating loadings, the discharger shall use the actual analytical concentration value unless it is less than 1/10 of the Regulation Method Detection Limit in which case the concentration is deemed to be zero for that parameter.

The daily plant loading limit is calculated as the product of the analytical concentration result of the monitored parameter and the flow rate of the monitored effluent stream for the day of sampling.

The monthly average process effluent plant loading is the arithmetic mean of the daily plant loading values.

The loading calculations for process and merged effluent streams must be performed as soon as the analytical results are available.
The calculations for cooling water loading must be performed in time to comply with the quarterly reporting requirement.

No loading calculations will be carried out for the parameter oil and grease. A monthly average concentration shall be calculated based on weekly sampling at each designated process sampling point.

## 6.5 Part IV - Parameter and Lethality Limits

Section 16 - Parameter Limits

Each plant must meet the daily and monthly average process effluent plant loadings specified in Columns 3 and 4 respectively of its specific Schedule 2 of the Regulation for the parameters shown in Column 1.

Each plant must meet a monthly average concentration of 15 mg/L of oil and grease at process effluent sampling points designated in Schedule 2.

Process effluents must meet a pH limit range of 6.0 to 9.5 at all times.

Section 17 - Lethality Limits

Process effluent streams, merged effluent streams and cooling water streams must be non-acutely lethal to rainbow trout and Daphnia magna. An acutely lethal effluent is one that kills more than fifty percent of the test species in 100 percent (undiluted effluent). The sampling points where the lethality limits apply are designated and are outlined in Schedule 6.

## 6.6 Part V - Monitoring

Section 18 - Monitoring - General

Collection of samples from an effluent stream is not required on a day when there is no discharge from that stream.

The Regulation requires that sufficient sample volume be taken to perform the required analyses and that all analyses be completed as soon as is reasonably possible.

In the Regulation the discharger is allowed to pick up the composite samples between the hours of 7:00 and 10:00 A.M. in order to allow the discharger, especially those plants with a large number of outfalls to collect all the samples. Deviations from the time allowed to pick up the samples may be granted on the basis of a written request from the discharger.

Sections 19, 20, 21, 22, 31 and 32 - Monitoring Effluent Streams

By July 12, 1995 each discharger shall monitor each process, merged and cooling water effluent monitoring stream. The monitoring requirements for daily and weekly process effluent sampling and analysis are set out in Schedule 2. For multi-process effluent plants, the specific parameters to be analyzed in each effluent are shown in Schedule 3.

The monitoring requirements for weekly and quarterly merged effluent sampling and analysis are set out in Schedule 4.

The monitoring requirements for weekly and quarterly cooling water effluent sampling and analysis are set out in Schedule 5.

Weekly samples must be collected at least four days apart. Quarterly samples must be collected at least 45 days apart.

Section 23 - Monitoring - Process Effluent - Quality Control

Effective July 12, 1995, once per year the discharger shall prepare and analyze duplicate, travelling blank and travelling spiked blank samples from a process effluent sampling point.

The duplicate samples are to be analyzed for the same parameters as are shown in Schedule 2 for weekly monitoring for the plant.

QA/QC samples must be collected at least six months apart on the same day as the weekly process effluent samples.

### Section 24 - Monitoring - Process Effluent - pH Measurement

Plants are required to measure pH daily, beginning July 12, 1995, by collecting three grab samples over a 24 hour period.

The first sample must be taken during the time period applicable to the plant (i.e. between 7:00 a.m. and 10:00 a.m.). The other two grab samples shall be collected at least four hours apart.

The Regulation allows the discharger to measure pH at an alternate sampling point located downstream of the designated sampling point provided that the discharger submit a written notification to the Director.

The discharger can use on-line pH measurement instead of grab samples. The location of the on-line analyzer does not need to be at the exact location of the designated sampling point where composite samples are being taken, as long as the pH measurement at its location is representative of the pH at the designated sampling point.

Three readings must be made. The first reading of pH must be taken during the time period applicable to the plant. The other two readings must be taken at least four hours apart.

### Sections 25, 26 - Monitoring - Acute Lethality Testing - Rainbow Trout, Daphnia magna

The discharger shall carry out both rainbow trout and Daphnia magna acute lethality tests monthly, according to Environment Canada procedures[16] [17], for compliance with the lethality limits at the designated sampling points outlined in Schedule 6.

Both lethality samples must be taken on the same day on which the weekly sampling for the analysis of limited parameters is being conducted. An interval of at least fifteen days is required between successive monthly lethality tests.

The acute lethality testing frequency at a sampling point can be reduced to quarterly following twelve consecutive monthly passes for that species (mortality of no more than 50% of the test species). However, the discharger shall revert to a monthly frequency if a single failure at the quarterly frequency occurs.

Notification of the Director as to the change in frequency is required. An interval of at least forty-five days is required between successive quarterly tests.

Sections 27 and 28 - Acute Lethality Testing - Rainbow trout and Daphnia magna

Beginning on April 13, 1998, on one day in each month, on a day during the weekly sampling, Atlas, Dofasco, Stelco Hilton Works and Stelco Lake Erie Works shall sample process effluent sampling points designated in Schedule 7 and shall perform a rainbow trout and Daphnia magna acute lethality test on each sample.

An interval of at least 15 days shall be maintained between successive pick-up days and all samples shall be picked up on the same day in the month. The frequency will be reduced to quarterly following 12 consecutive months of sampling.

An interval of at least 45 days shall be maintained between successive pick-up days and all samples shall be picked up on the same day in the quarter.

Section 29 - Toxicity Elimination Report (TER)

If three consecutive acute lethality tests result in mortality of more than 50 per cent, the discharger shall submit to the Director a TER.

A TER, to be submitted no later than 12 months after the day following the third failure, shall include:

- A detailed analysis of the causes and sources of lethality.
- A synopsis of any studies conducted to support the analysis.
- A detailed description of the methods to eliminate the lethality.
- An evaluation of the technical feasibility of implementing each method.
- An estimate of the financial cost to the discharger of implementing each method.

In addition to the TER, the discharger shall submit to the Director annual progress reports, no later than the anniversary of the day on which the toxicity elimination report was required to be submitted under subsection (3).

An annual progress report shall set out the following information:

- A detailed description of any additional methods, by which the quality of the stream could be controlled to eliminate the toxicity.
- An evaluation of the technical feasibility of implementing and a statement of which of the methods are technically feasible.
- An estimate of the financial cost to the discharger of implementing each method identified as technically feasible.

Where three consecutive quarterly toxicity tests are non-lethal, the discharger is relieved of the obligations of submitting annual toxicity elimination progress report.

Where a discharger was relieved of the obligation to submit toxicity elimination progress reports and then there were three consecutive quarterly tests result in mortality of more than 50%, the discharger shall resume the submission of the annual toxicity elimination progress report, until a further three consecutive quarterly tests are non-lethal.

Section 30 - Monitoring - Chronic Toxicity Testing

Fathead Minnow and Ceriodaphnia dubia chronic toxicity testing, according to Environment Canada procedures[18] [19], is required semi-annually at the designated sampling points outlined in Schedule 9. This testing is only required if both rainbow trout and Daphnia magna acute lethality tests are non-lethal for twelve consecutive months.

An interval of at least ninety days is required between successive sampling.

## 6.7 Part VI - Effluent Volume

Sections 33 and 34 - Flow Measurement and Calculation of stream and plant Volumes

Each discharger shall determine in cubic metres a daily volume of effluent for each process, merged and cooling water effluent monitoring stream for each day on which a sample is collected from the stream, by integration of continuous flowrate measurements.

Volumes for process, merged and cooling water effluent monitoring streams to be determined to an accuracy of 15 per cent, 20 per cent and 20 per cent respectively.

No later than July 12, 1995, each discharger shall determine by calibration or confirm by means of a certified report of a registered professional engineer of the Province of Ontario that the above accuracies are met.

The discharger shall determine by calibration or confirm by means of a certified report of a registered professional engineer of the Province of Ontario that each new or altered flow measurement method meets the accuracy requirements.

Maintenance and calibration schedules for each flow measurement system installed shall be developed and implemented.

Each flow measurement system has to be set up in a way that permits inspection by a provincial officer.

Each discharger shall calculate, in cubic metres, daily and monthly average process, merged and cooling water effluent stream volumes as well as plant volumes for each month.

A plant or stream volume for a day is the sum of the daily volumes.

A monthly average plant or stream volume for each month is the arithmetic mean of the daily plant/stream volumes.

## 6.8 Part VII - Storm Water Control

Section 35 - Storm Water Control Study (SWCS)[20]

The SWCS is in force on April 13, 1995. Each discharger shall:

- Collect and analyze samples during four representative storm events (Two types of samples are required: First flush grab sample during the first 30 minutes and composite or three grabs equally spaced over three hours.)
- Sample only one outfall If there are identical storm water outfalls.
- Sample each cooling water stream which receives storm water during the four representative storm events.
- Analyze for the limited and assessment parameters.

- Perform pass/fail rainbow trout and Daphnia magna toxicity tests on samples collected during the first flush.
- Prepare a site map showing sampling locations, drainage areas.
- Determine the daily rainfall and monthly total rainfall over the study period.
- Estimate the total area drained by each sewer and the impervious areas.
- Estimate the volume of storm water discharged based on calculated flow rates or runoff coefficient and rainfall drainage areas, and assess the accuracy of method used.
- Verify that no process water is being discharged through storm sewers.
- Calculate loadings of storm water discharges

The SWCS Report includes as a minimum:

- All monitoring results
- Identification of potential sources of storm water contamination.
- The relative contribution of storm water loadings to the daily process and cooling water loadings.
- Potential sources of lethality, if any, of storm water discharges.
- Description of prevention and control measures that are presently used and those that can be used to reduce storm water contamination.
- Options for prevention and/or control of storm water contamination, the preferred option, time table and cost for implementation.

A discharger can submit exemption if qualified within one year

Exemption criteria

- Plant can be divided into exempt and non-exempt.
- Storm water that do not come into contact with industrial activity.

- Storm water associated with parking lots, administrative buildings and landscaped areas that do not come into contact with industrial activities.
- Storm water that are directed to sewage works with a C of A.
- Storm water that are mixed with process water and are monitored under the regulation

The discharger who applies for exemption has to submit a letter to the Director asking for exemption. Documentations to support the claim are to kept on file and made available upon request.

Typical documentations are:

- A plant layout showing the collection system
- All available monitoring data (concentration and flow).
- Loadings of storm water discharges that are treated separately from process effluents.
- A description of treatment facilities, BMP's.

Studies which meet the protocol requirements and completed within five years of the date on which the regulation comes into force can be used for the purposes of the study.

The SWCS shall be completed SWCS within two years. However, if BAT has to be installed, or, changes in processes are expected, the discharger shall notify Director within two years and the SWCS shall be completed within four years.

## 6.9 Part VIII - Records and Reports

Section 36 - Record Keeping

Each discharger shall keep all records specified by the regulation for a period of three years and upon request make them available to the Ministry for inspection.
Record keeping requirements include the following:

- all concentration, flow and pH results for each process effluent and cooling water effluent records shall be kept in electronic format.
- sampling and analytical procedures and sample pick-up information

- toxicity testing
- flow device maintenance and calibration
- all problems or malfunctions with a potential to affect compliance
- all by-passes
- all process changes impacting the quality of the discharge

Section 37 - Reports Available to the Public

A report on a summary of loadings associated with process, alternate and cooling effluent streams, by passes, toxicity testing, and exceedance of loading and lethality limits is to be prepared on or before June 1 in each year and made available to the public on request.

Section 38, 39, 40, and 41 - Reports to the Director

There four types of reports that the discharger shall make available to the Director:

1. A notification in writing when there is:

- a change of plant name or ownership
- any process change, redirection or change that affects the quality of the effluent for a period of one week or longer
- a reduction of 75% in the daily production rate, which is specified in column 3 of Schedule 9, for a period of 90 consecutive days.

2. A verbal report, to the Director as soon as reasonably possible, on:

- all by-passes of sampling points,
- all exceedances of any of the parameter limits shown in Schedule 2'
- all failures to meet the regulated pH range, and
- all failures to meet the acute lethality limits

The discharger shall also submit a written notification as a follow-up to the verbal report.

3. Quarterly reports to the Director in electronic and hard copy no later than forty-five days after the end of each quarter.

The quarterly reports shall include:

- a list of all exceedances of limits
- the monthly average flows and loadings of each process effluent monitoring stream, cooling water effluent stream and alternate effluent stream and the highest and lowest daily of each process, alternate and cooling effluent flow and loading for each month.
- the monthly average plant loadings and plant flows and the highest and lowest daily plant loadings and plant flows for each month for limited and assessment parameters.
- the number of process effluent discharge days in each month
- the highest and lowest pH readings for each month for each process effluent monitoring stream

4. Semi-annual reports on the results of chronic toxicity testing within forty-five days of the end of each semi-annual period.

The report is to include a plot of percentage reduction in growth or reproduction and a calculation of the concentration at which 25% reduction in growth or reproduction would occur.

## 6.10 Part IX - Commencement and Revocation Provisions

Section 42 - Revocation of O. Regulation 321/89

The following Iron and Steel Sector Regulation 321/89, 602/89 and 139/90 are revoked on July 12, 1995.

Section 43 - Commencement of Parts IV, V, VI and VII

Part IV, Parameter and Lethality Limits, which requires compliance with parameter and lethality limits, comes into force on April 13, 1998.

Parts V and VI, Monitoring - Chemical Parameters/Acute Lethality and Chronic Toxicity and Part VII, Effluent Volume, requiring effluent monitoring and flow measurement, come into force on July 12, 1995.

# Appendix I
# A Profile for the Ontario Iron and Steel Sector

The following is a brief summary of each process subcategory in the Ontario Iron and Steel MISA plants:

## A1.1 Cokemaking

Coke is produced at all of the four integrated mills - Algoma Steel Inc., Dofasco Inc., the Stelco Hilton Works and the Stelco Lake Erie Works (LEW).

The production of metallurgical coke is an essential part of the steel industry, since it provides one of the basic raw material necessary for the operation of ironmaking blast furnaces.

The cokemaking process not only produces high-quality coke but also provides a means of recovering valuable by-products of the distillation reaction. During this process, air is excluded from the coking chambers, while heat is supplied from the external combustion of flue gases in flues located within dividing walls separating adjacent ovens. The volatile components are recovered from the coke oven gas stream and processed in a wide variety of ways to produce tars, light oils, ammonium compounds, naphthalene. The coke oven gas is used as an energy source for other production units in the plant.

The by-product recovery processes generate excess flushing liquors, benzol plant wastewater, indirect ammonia recovery plant wastewater, final cooler wastewaters, desulfuriser wastewaters, air pollution control scrubber effluents, and tar decanter wastewaters in addition to the wastewaters from coke quenching operations.

Algoma Steel has three coke plants. Cokemaking wastewaters are directed to ammonia stills (free leg only) and a dephenolizer. A fluidized bed biological treatment plant, similar to that installed at Hoogovens in Holland is installed on site but is not operational yet.

Dofasco has three coke plants. Coke-side pushing emissions from the No.1 Coke Plant are cleaned with a wet electrostatic precipitator. The effluent from the wet electrostatic precipitator is directed to the No. 1 Coke Plant Quench Tower Sump. The No.2 Coke Plant uses a baghouse to clean its pushing emissions and does not have a water effluent. The No.3 Coke Plant uses a wet gas scrubber and directs its effluent to the quench tower sump and in turn to the quench tower.

Cyanide is removed from the coke oven gas in two Hydrogen Cyanide Plants. The #1 HCN plant removes cyanide as ammonium thiocyanate ($NH_4SCN$) which is subsequently converted to ammonium sulphate [$(NH_4)_2SO_4$] and carbon dioxide using the Zimpro wet oxidation process. The #3 HCN Plant uses sodium carbonate to remove hydrogen cyanide. Spent liquor is blown down to a reductive burning recovery unit (RBR) which recovers the chemicals for reuse.

Excess flushing liquor from the three coke plants is directed to the Flushing Liquor Ammonia Removal Plant (FLARP) consisting of two ammonia stills (free and fixed leg). Effluent from the Ammonia Stills is sent to an aerobic biological treatment plant prior to discharge. The biological treatment plant consists of an aeration section followed by a secondary clarifier. The treatment plant appears to be overloaded, and waste activated sludge is discharged to the Hamilton-Wentworth Municipal Sewage Treatment Plant. The plant operation (maintenance of MLVSS or F/M ratios, or SRT) does not appear to be optimized. Effluent from the final clarifier goes to the Bay without tertiary treatment.

There are three process wastewater streams from four operating Coke Oven Batteries and two by-product plants at the Stelco Hilton Works. A wet electrostatic precipitator clean the Coke Side Shed pushing emissions and the effluent flows to the East Side Filtration Plant (ESFP).

Stack sump condensate and coke wharf drainage effluent discharge directly to Hamilton Harbour. Quench water recycles through the breeze basin and any breeze basin overflow discharges directly to Hamilton Harbour. The Coke Oven Batteries use small amount of NCCW on a once-through basis.

The By-Products Plants produce two process wastewater streams. The effluent from the interceptor sumps flows to the ESFP. The effluent from the ammonia stills is discharged to the sanitary sewer for treatment at the Regional Municipality Sewage Treatment Plant.

Stelco Lake Erie Works cokemaking wastewaters, including waste ammonia liquor, fractionator bottoms and intercepting sump water, are collected in an equalization tank then pumped to the ammonia still for removal of free and fixed ammonia. Caustic is added to the ammonia still to improve the removal of fixed ammonia. The ammonia concentration is reduced to between 100-150 ppm after the still. The use of caustic instead of lime for the removal of fixed ammonia in the ammonia still reduces the amount of solids to be landfilled since there is no solids associated with the use of caustic.

The wastewater from the ammonia still flows to the biological treatment plant. The Biological Treatment Plant consists of a primary clarifier, two aeration basins in series, and a final clarifier. The primary clarifier is used only for additional equalization since fixed leg of ammonia still was converted to caustic from lime.

The retention time in each aeration basin is about 19 hours. Approximately 20% of the untreated water is directed to the second basin to maintain an adequate carbonaceous food supply in the basin to feed the bacteria. The average sludge age in the basins is 80 days. The water from the second basin is clarified in the secondary clarifier, then pumped to the Blowdown Treatment Plant where pH adjustment for dissolved metals precipitation followed by alkaline breakpoint chlorination to achieve cyanide phenolic and ammonia removal.

The biological treatment plant is well operated and has been modified and optimized from its original design basis.

Most of the sludge is returned to the aeration basins. The excess sludge is dewatered further in a thickener and sprayed onto the coal at the coal conveyor for return to the ovens.

The pushing emissions control wastewater and the non-contact cooling water blowdown are used for coke quenching at the quench tower breeze basin.

The practice of spraying the biological sludge onto the coal to the coke ovens reduces the requirement for solids disposal and adds to carbon back into the system. The use of the PEC blowdown for coke quenching may cause the fine particulates in the water to be re-suspended which would adversely affect air quality.

## A1.2 Sintering

During iron and steel production operations, large quantities of particulate (fines, mill scale, flue dust) are generated. A large percentage of this iron rich material is recycled through the sintering operations. The sinter (fused material) produced by the sintering operation is reused as raw material in blast furnaces.

These recycled iron bearing materials are mixed with iron ore, limestone and coke breeze and placed on a travelling grate of the sinter machine. Near the head end of the grate, the surface of the raw material is ignited. As the mixture moves along on the travelling grate, air is drawn down through the mixture to enhance combustion and to sinter the fine particles. As the bed burns, carbon dioxide, cyanide, sulfur compounds, chlorides and fluorides are driven off with the gases. Oil and grease on the mill scale is vaporized and driven off. At the discharge end of the machine the sinter drops off and is cooled either by air or a water spray and then crushed and screened. Wastewaters are generated in this process as a result of scrubbing the gases and dust associated with the sintering process.

Stelco Hilton is the only one of the integrated mills in Ontario that has sinter plant production.

Wastewater from ironmaking gas cleaning operations is fed to the Stelco Hilton sinter plant. This water is used on a once-through basis and then discharged to the East Side Filtration Plant for final treatment prior to discharge.

## A1.3 Ironmaking

Molten iron is produced by the reduction of iron bearing ores with coke and limestone in blast furnaces. Blast furnaces are large cylindrical structures in which iron oxides react with the hot carbon monoxide from the burning coke, and the limestone reacts with impurities in the iron bearing material and the coke to form molten slag.

These reactions start at the top of the furnace and proceed to completion as the charge passes to the bottom of the furnace. The molten slag which floats on top of the molten iron is drawn off (tapped) by way of a tapping hole. The molten iron is also tapped through a hole below the slag tapping hole. The production of iron from a blast furnace is based upon the following approximate charge and yield relationship:

| Charge (raw material) | Yield |
|---|---|
| 1.8 tonne iron ore, | |
| 0.6 tonne of coke, | 0.9 tonne iron |
| 0.45 tonne of limestone, | 0.5 slag |
| 3.2 tonne of air | 4.5 tonne process gas |

The gases which are produced in the furnace are exhausted through the top of the furnace. These gases are cleaned, cooled and then burned to preheat the incoming air to the furnace. Gas cleaning involves the removal of the larger particulates, by a dry dust collector followed by a wet gas cleaning systems for fine particulate removal.

Ironmaking at Algoma is carried out in two blast furnaces No. 6 and No. 7. Off-gases from the blast furnaces are cleaned by Venturi Scrubbers, and scrubber effluent is discharged to

Thickener No. 2 for suspended solids reduction prior to discharge. No recycle is practised.

Dofasco implemented a new blast furnace gas washing water recycling system for its four blast furnaces during the MISA monitoring period. The system consists of a thickener with sludge management system, cooling tower and recycle pumps. Blowdown is filtered by a Dyna sand filter prior to discharge. Effluent from the Ironmaking Ladle cleaning stations and Desulphurization stations are treated in the BOF (Basic Oxygen Furnace) thickener.

Stelco Hilton has two blast furnace operations, furnace "D" and "E". Both furnaces are served by wet gas cleaning systems, which incorporate thickeners and coolers (E) or a cooling Tower (D), and recycle pumps.

, The make-up and blowdown of the gas cleaning water from the blast furnace are maintained to allow it to cascade to the sinter plant where it is used on a once-through basis prior to discharge to the East Side Filtration Plant. Both D and E furnace thickener underflows discharge to a sludge thickener where sludge is thickened and dewatered on vacuum drum filters and conveyed to the sinter plant as feed material.

Stelco LEW has one blast furnace equipped with a Bischoff scrubber for gas cleaning. Scrubber water is discharged to a thickener then to a cooling tower and then recycled to the furnace scrubber. Sludge from the thickener is dewatered and stored on site for future recovery of its iron value. The recycle system achieves 94% recycle. Blowdown from this system is sent to the Blowdown Treatment Plant for further reduction in suspended solids, ammonia, cyanide and metals.

## A1.4 Steelmaking

Steel is an alloy of iron which contains less than 1% carbon. Steelmaking process is a process in which carbon, silicon, phosphorus, manganese and other impurities present in the molten iron or steel scrap are oxidized to specific levels.

The molten steel is then either teemed into ingots or transferred to a continuous casting operations for direct conversion into a semi-finished product (i.e. slabs, billets and blooms). The major steelmaking processes are the Basic Oxygen Furnace (BOF)and Electric Arc Furnace (EAF).

Steel is made in basic Oxygen Furnaces by two methods - open combustion in which sufficient air is drawn in to the furnace to fully convert carbon to carbon dioxide; and suppressed combustion in which oxygen supply to the furnace is limited to convert carbon to carbon monoxide (which is then used as fuel elsewhere).

The open combustion system off-gases are cleaned either by wet scrubbing (e.g. Algoma) or by dry methods - electrostatic precipitator (eg. Stelco Hilton). The suppressed combustion systems with wet gas cleaning is practised at the Stelco Lake Erie Works. Open combustion systems have much larger gas flows, and generally finer particulates than suppressed combustion systems. Larger volumes of scrubber water at higher pressures are required for open combustion systems.

Steel is made in Electric Arc Furnace (EAF) using dry gas cleaning systems at Atlas Specialty Steels, IVACO and LASCO.

Steel is produced at Algoma from No. 1 and No. 2 Basic Oxygen Steel Plants by the open hood or full combustion method. Gas cleaning wastewater from both BOSPS is discharged to No. 1 thickener for suspended solids reduction prior to discharge to the St. Mary's River via the Bar and Strip lagoon. The No.#2 Basic Oxygen Plant was shut down in early 1993.

Dofasco has two steel production shops - No. 1 Melt Shop contains No. 1, 2, and 3 Basic Oxygen Furnaces (BOFs) and No. 2 Melt Shop contains No. 4 BOF. No. 1 Melt Shop was closed in November 1993. All wastewater from the gas cleaning scrubbers is pumped to the BOF thickener for suspended solids reduction. From here it is discharged without recycle or further treatment.

The Stelco Hilton Works produces steel at 3 BOFs numbers 4, 5, and 6. All gas cleaning is done by a dry process. All BOFs are open combustion. There is no direct process water associated with Stelco Hilton's Steelmaking operations.

The Stelco Lake Erie Works produces steel in a two vessel suppressed combustion BOF. Gas cleaning scrubber water is passed through hydro cyclone separators then to a gravity thickener prior to recycle. The recycle system receives blowdown from the Hot Strip Mill recycle system and the Vacuum Degasser as make up to the BOF gas cleaning water. Blowdown form the BOF goes to the Blowdown Treatment Plant where it receives further treatment for suspended solids removal and metals removal.

## A1.5 Vacuum Degassing

Of the four integrated mills in Ontario, only two, Dofasco and Stelco LEW utilize vacuum degassing in their production process. The vacuum degassing operation serves as an intermediate step in steelmaking. Degassing is performed when required by the steel order specification. The refining process in the vacuum degassing entails the removal of carbon, oxygen, hydrogen and nitrogen from the molten steel.

After the hot metal has been refined to steel in the Basic Oxygen Furnace or Electric Arc Furnace, the molten steel is transferred to the vacuum degasser for further refining. The molten steel which contains 0.5% of carbon, is oxygen-lanced while under vacuum. This reduces the pressure of the carbon monoxide being formed to levels well below atmospheric and permit the removal of carbon (less than 0.05%) while limiting the oxidation of other metals (e.g. chromium) needed for the production of low or ultra low carbon steel and other specialty steel products.

At Dofasco's No.2 Melt Shop (No.2 BOF) vacuum degassing operations are performed in the ladle. The ladle degassing fits the plant's need for a limited low carbon steel. The condenser blowdown discharges into the No. 1 caster scale pit and then to the No.2 Hot Mill Filter Plant.

At the Stelco LEW an RHOB vacuum degasser system is employed on about 70% of the Steel output. In the vacuum degasser operation The intercondenser water is recirculated. The blowdown which is the underflow of the inclined plate separator is discharged to the BOF gas cleaning system.

Atlas Speciality Steels uses a unique process which consists of two units - a vacuum degassing unit and an oxygen blowing decarburization unit. Large volumes of dusts and metal oxides are generated during the oxygen blowing process. These dusts and oxides are captured within the vacuum system and are discharged into the effluent system.

## A1.6 Continuous Casting

In the continuous casting process, the hot molten steel is poured from the ladle into a refractory lined tundish. The tundish serves to maintain a constant head of molten metal. This is essential in providing a controlled casting rate. The tundish can also distribute the molten steel to more than one casting strand in multiple strand operation. The tundish pours through nozzles into an oscillating water cooled copper mould. The copper moulds oscillate to prevent the molten steel from sticking to the sides of the moulds. Lubricants are sprayed into the moulds to facilitate the steel movement through the mould.

As the metal solidifies in the mould, the cast product is withdrawn continuously. After passing through the water cooled moulds, the partially solidified product passes into a secondary cooling zone where sprays of water remove sufficient heat to complete solidification of the semi-finished products. The product then passes into the cut-off zone where it is cut to the desired length.

Algoma Steel has two casting plants, No. 1 fed by No. 1 BOF and No. 2 slab caster fed by the No. 2 BOF. The round caster plant construction has been halted and is not yet started up. Once through contact cooling water from No. 1 plant goes to the Bar and Strip Lagoon and is then discharged to the River. Once through slab caster contact cooling water goes to the main filter plant prior to discharge.

Dofasco No. 2 Hot Mill filtration plant receives wastewaters from the vacuum degassing and continuous caster. The treatment system consists of large scale pits, settling basis, sand filters, cooling towers and recycle pumps. The system achieves 97% recycle. Backwash from the filters is sent to decant basins. No effluent quality data is available for the Continuous Caster operations as these are integrated with the Hot Strip Mill.

There are two continuous casting machines at the Stelco Hilton Works. The No. 1 caster produces blooms and slabs, and the No. 2 machine is a slab caster. Mould and machine cooling water systems are closed loop. Some recycle of contact cooling water is practised from the caster scale pits. The blowdown from the caster scale pits goes to the East Side Filter Plant prior to discharge.

Stelco LEW has a two strand continuous slab caster. Contact cooling water is conveyed to a scale pit, followed by sand filters and a cooling tower and then recycle to the caster. Blowdown consists of filter backwash which is directed to the BOF pumphouse dirty water sump, and ultimately to the Blowdown Treatment Plant for treatment.

Both Dofasco and Stelco Lake Erie Works employ modern recycle systems for caster contact cooling water. Stelco Lake Erie Works is selected as BAT #1 since effluent quality data are available and the filter backwash (which is the system blowdown) is treated together with the process water in the Blowdown Treatment Plant.

Dofasco's No. 2 Hot Mill Filter Plant is similar to the Stelco LEW system with respect to contaminants discharged, but no data are available. In addition, the filter backwash is partly treated in the steelmaking clarifier.

Atlas Steels processes 50% of its steel through a continuous caster. The continuous caster is known as a 3 strand billet/bloom caster. Stainless steel, high alloys and low alloys are all processed through the caster. Wastewater is co-treated with those of the hot forming operations at the North Plant Water Treatment facility.

Lasco operates two continuous casting machines: 3 strand billet caster in the #1 Melt shop and 5 strand billet caster in the #2 Melt shop. Direct cooling water is used to cool the casters and the hot mill operations at a rate of 35000 USGPM. The wastewater is pumped to two scaling pits for the removal of heavy solids. From the scale pits the water overflows to a cooling/settling pond for the removal of finer solids. A blowdown of 850 USGPM is discharged to the south pond for final settling prior to discharging to Lake Ontario.

Ivaco operates a billet continuous casting machine. The mould cooling water is a closed system. The billet spray cooling water together with the cooling water for the EAF and those from the hot forming operations are recycled with no discharge of process water.

The Arc Furnace Water system recirculates NCCW over an evaporative cooling tower and provides cooling for the electric furnaces and miscellaneous heat exchangers and air conditioner heat exchangers.

The mill currently recycles 100% of its process water and discharges approximately 110 $m^3$/day NCCW to the Ottawa River via Mill Creek.

Ivaco advised that they could not maintain zero discharge at this time and they have requested approval to discharge a flow of up to a maximum of 1.0 $m^3$/tonne.

## A1.7 Hot Forming

All iron and steel plants in Ontario have hot forming operations ranging from strip to structural to tubes.

Algoma's central hot forming mills manufacture blooms, slabs, rails, and hot strip. Contact cooling water is discharged to scale pits and sometimes limited recycle is operated. Wastewater is conveyed to the main filter plant where it is treated for solids and oil removal and then discharged to the River. The tube mills - No. 1 and No. 2 are located to the other side of Davignon Creek. No. 2 Seamless Tube mill is equipped with scale pit, sand filters, cooling tower and achieves a high rate recycle. The blowdown from this system is comparable with other high recycle systems at 4.4 $m^3$/tonne. No. 1 Tube Mill is a once through system without filtration.

Dofasco has two hot strip mills. The No.1 Hot Strip Mill is ingot fed with a capacity of 3.1 million tonnes per year. This mill was closed in November 1993. The No.2 Hot Strip Mill is continuously cast slab fed with a capacity of 2.7 million tonnes per year.

During the MISA monitoring period, wastewater from the No. 1 Hot Mill was treated in the No. 1 Hot Mill Water Filtration Plant. The plant has 8 pressure type filters and 6 gravity deep bed filters. Approximately 30% of the effluent is recycled to the No. 1 Hot Strip Mill and the remainder discharges to Hamilton Harbour.

The No. 2 Hot Mill filtration plant treats the effluent from the No. 2 Hot Strip Mill, the twin strand caster and the No. 4 BOF Vacuum Degasser. The filter plant consists of two settling basins followed by 17 gravity deep bed filters. The filter backwash is directed to a decant basin where the sludge is separated from the supernatant. The sludge is pumped to the BOF Thickener for treatment prior to discharge, while the supernatant is returned to the settling basins. The filtrate is cooled by forced draft cooling towers prior to recycling to the #2 Hot Strip Mill and the Caster. Actibrome and Sodium hypochlorite are added to the recycled water. Overall, a 98 percent recycle rate is achieved.

Stelco Hilton's central hot forming operations consist of the Universal Slabbing Mill, 148" Plate Mill, Hot Strip Mill and No. 1 Bar Mill. Local recycle is practised at the Universal Slabbing Mill (scale pit and cooling tower), 148" Plate Mill (Scale pit), and No. 1 Bar Mill (circular scale pit). The blowdown from these local recycles and once through flows from the Hot Strip Mill are sent to the East Side Filtration Plant prior to discharge. The No. 3 Bloom and Billet Mill, also located in the main plant area, has a scale pit and filter system and recycles about 50% wastewater. The blowdown is discharged to the North outfall.

No. 2 Rod mill is located at a site about 1 mile away from the main Hilton works complex. Once through process water is treated in a scale pit and lagoon prior to discharge.

Stelco LEW's Hot Strip Mill process water flows to a large lagoon where oil is removed and gross solids deposited. From there the water is filtered in sand filters and cooled prior to recirculation. This system achieves a blowdown of 0.85 $m^3$/tonne.

The blowdown from the system is the filter backwash which is decanted and the underflow conveyed to the BOF gas cleaning system. MISA data indicate that effluent characteristics are comparable with Dofasco No. 2 Hot Mill and Algoma No. 2 Tube Mill.

Atlas Specialty Steels hot forming operations consist of one bloom/billet mill and one bar mill. Wastewater from the bloom/billet mill is treated at the North Water Treatment facility. Wastewater from the bar mill is treated at the South Plant Water Treatment facility.

The Hot Forming operations take place at a ten strand Light Structural Mill and a 17 strand Bar Mill at Lasco.

The hot forming operations at Ivaco entails the production of wire rods from the billets.

## A1.8 Finishing

The finishing subcategory include acid pickling, cold rolling, alkaline cleaning, hot coating and electrolytic plating operations.

Acid pickling is the steel finishing process in which steel products are immersed in heated acid solutions to remove surface oxide scale. Temperature, agitation and acid and iron concentrations of the acid baths are important operating factors in the pickling process since they affect the rate of reaction. Wastewaters are generated by three major sources:

- The rinsewater used to clean the acid solution from the product after it has been immersed in the acid solution;
- The spent pickle liquor which is the acid solution that has become too weak to continue to treat the steel products;
- Absorber vent scrubber wastewater associated with hydrochloric acid regeneration plant.

The cold rolling is the process in which flat unheated steel products are reduced in thickness by rolling operations. Due mainly to the use of oil solutions, various pollutants are discharged from the cold rolling mills.

Alkaline cleaning is used where vegetable and animal fats and oils and mineral oils must be removed from the steel surface prior to further processing such as hot coating or electrolytic plating.

The installation of counter-current (cascade) rinse systems can substantially reduce the rinsewater flows discharged from the alkaline cleaning process. This system is currently practised at the finishing operations in Ontario, use a multiple tank arrangement in series. The product being cleaned travels in the opposite direction to the water flow and thus encounters progressively cleaner water.

This type of arrangement reduces the wastewater flow, concentrates the pollutants in the first rinsing chamber and achieves a more thorough rinsing because of the multiple rinsing achieved in the series tanks.

This type of rinsing, used for both batch and continuous operations, apply for rinsing operations in acid pickling and hot coating.

Hot coating processes involve the immersion of clean steel into baths of molten metal for the purpose of depositing a thin layer of the metal onto the steel surface. These coatings provide desired qualities such as resistance to corrosion or a decorative bright appearance. Hot coating for zinc and tin is applied at the Stelco Hilton Works and Dofasco Steel. Zinc coating is most often applied from molten metal baths while tin is applied electrolytically from plating solutions.

Algoma's Finishing production is located at the cold mill. Processes consist of acid pickling, reduction mill and temper mill. Waste pickle liquor is 40% sold to Southern Ontario sewage treatment plants, 60% disposed of to slag dump. Acidic rinse waters are conveyed to the No. 1 thickener (steelmaking).

The reduction mill uses lubricant and roll coolant containing 5% animal fat, which is disposed of to the coal pile after use. Soap solutions from the Temper mill operations discharges to the collection sumps in the basement together with floor drains. This wastewater is conveyed to an external oil/water separator. Underflow is conveyed to the main filter

Finishing operations at Dofasco include Acid Pickling, Cold Rolling, Alkaline Cleaning, Annealing, Galvanizing, Electrolytic Tinning, Tempering, and Coating. There are three finishing plants at the Dofasco facility. These include the Main Plant, the Kenilworth Plant and the Bay Front Finishing Operations. The Main Plant finishing facilities are as follows:

- No. 1, 2 and 3 Pickle Lines
- No. 1 and 2 Cleaning Lines
- No. 1 and 2 Tandem Cold Mills
- 4-56 Inch Cold Mill

- 1-66 Inch Cold Mill
- 42 Inch Temper Mill
- 56 Inch Temper Mill
- 1-66 Inch Temper Mill
- 2-66 Inch Temper Mill
- Batch Annealing Lines
- Open Coil Annealing Lines
- No. 2 Tower Anneal Line
- No. 1 and 2 Galvanizing Lines
- No. 2 and 3 Electrolytic Plating Lines

The wastewater from the Main Plant finishing operations, including oily wastewater, alkaline and acid rinses, is treated at the Cold Mill Wastewater Treatment Plant. Treatment facilities consist of pH adjustments followed by settling in clarifiers prior to discharge to the Hamilton-wentworth Pollution Control Plant. Oily wastewaters are also treated by emulsion breaking and oil/water separation. Effluent quality varies considerably essentially due to insufficient storage capacity to smooth variations in flow and loading from several different sources.

Spent pickle acids are recovered in the No. 1 Acid Recovery Plant. Wastewater from the No. 1 ARP tail gas scrubbers is currently discharged to the #1 hot mill filter plant after neutralization.

Electrolytic Chrome wastewaters from No. 2 and No. 3 electrolytic plating lines are treated separately by ion exchange prior to discharge off site.

Finishing facilities are also located at the Bay Front Finishing Operations. This plant has the following finishing facilities:

- No. 3 Galvanizing Line
- No. 4 Galvanizing Line
- No. 5-56 Inch Cold Mill
- Magnesium Oxide Coating Line

The rinsewater and sump water from the No. 3 and No. 4 Galvanizing Lines is discharged directly to the sanitary sewer system. Spent high density cleaning solution from the No. 4 Galvanizing Line and the wastewater from the recoiler and payoff pits at the No. 3 and No. 4 Galvanizing Lines is collected and transported to the Main Plant Cold Mill Wastewater Treatment Plant. Waste rolling solution and washdown water from the No. 5-56 Inch cold Mill is also treated at the Main Plant Cold Mill Wastewater Treatment Plant. The wastewater from the Magnesium Oxide Coating Line is directed to the Magnesium Oxide Clarifier then discharged to the sanitary sewer system.

The Kenilworth Plant finishing operations include the No. 4 Pickle Line and the new Continuous Pickle Cold Mill Line. The acid rinse from the No. 4 Pickle line, wastewaters from the No. 2 ARP tail gas scrubbers and acid rinses from the new Coupled Pickling/Cold Mill line are pre-treated in the newly constructed treatment facility prior to discharge to the Hamilton-Wentworth Sewage Treatment Plant.

The new treatment facility consists mainly of neutralization followed by clarification and filtration. A major feature of the treatment system is the use of a mechanical vapour compression evaporator to treat oil emulsions. water vapour produced is condensed and recycled back to the mill. Oil produced is collected together with other oil skimmed from various holding tanks for separation into oil, water and solids.

Stelco Hilton finishing operations, include cold rolling, cold rolled sheet finishing, tin coating, galvanizing and acid pickling. The plant has the following finishing facilities:

- 4-stand 80" mill
- 5-stand 48"mill
- 3 hydrochloric acid pickling lines
- 3 Temper rolling mills
- #1 and #2 continuous annealing.
- #2 and #3 electrolytic tinning
- #1, #2, #3, and #4 galvanizing lines. The #4 line is a new electrogalvanizing "Z" line.

In general, oily wastes are treated at Waste Oil Recovery Plant, (which includes pH adjustment, addition of flocculant chemicals and dissolved air flotation process). After treatment effluent flows to the East Side Filtration Plant (ESFP). Acid Pickling spent acids are recovered in the HCl Acid Regeneration Plant. Rinse waters are cascaded on lines 1 and 2, and cascaded and recycled on line 3, and discharged to the ESFP. Rinse water from Electrolytic Tinning lines are discharged to the ESFP. Spent acid and alkali solutions are stored on site for disposal off site. Chrome solution is treated at the ion exchange plant. Rinse water from No. 1 Galvanizing line and the new Z line discharge to the ESFP. Spent acid, alkali and chrome solutions are collected, treated, and disposed of off-site.

The Acid Pickling the Salt Bath Descaling operations at Atlas Speciality Steels were shut down in early 1993.

Stelco Lake Erie Works, Lasco and Ivaco do not have finishing operations.

# Appendix II
# Sector List of Parameters Monitored

Table A2.1
Integrated Steel Mills

| ATG | PARAMETER | RMDL | UNIT |
|---|---|---|---|
| 2 | Cyanide Total | .005 | mg/L |
| 3 | Hydrogen Ion (pH) | | |
| 4a | Ammonia plus Ammonium | .250 | mg/L |
| | Total Kjeldahl Nitrogen | .500 | mg/L |
| 4b | Nitrate+Nitrite | .250 | mg/L |
| 5a | DOC | .500 | mg/L |
| 5b | TOC | 5.000 | mg/L |
| 6 | Total Phosphorus | .100 | mg/L |
| 7 | Specific Conductance | 5.000 | uS/cm |
| 8 | Total Suspended Solids | 5.000 | mg/L |
| | Volatile Suspended Solids | 10.000 | mg/L |
| 9 | Aluminum | .030 | mg/L |
| | Beryllium | .010 | mg/L |
| | Cadmium | .002 | mg/L |
| | Chromium | .020 | mg/L |
| | Cobalt | .020 | mg/L |
| | Copper | .010 | mg/L |
| | Lead | .030 | mg/L |
| | Molybdenum | .020 | mg/L |
| | Nickel | .020 | mg/L |
| | Silver | .030 | mg/L |
| | Thallium | .030 | mg/L |
| | Vanadium | .030 | mg/L |
| | Zinc | .010 | mg/L |
| 10 | Antimony | .005 | mg/L |
| | Arsenic | .005 | mg/L |
| | Selenium | .005 | mg/L |
| 11 | Chromium (hexavalent) | .010 | mg/L |
| 12 | Mercury | .100 | ug/L |
| 14 | Phenolics (4AAP) | 2.000 | ug/L |
| 15 | Sulphide | .020 | mg/L |
| 16 | 1,1,2,2-Tetrachloroethane | 4.300 | ug/L |
| | 1,1,2-Trichloroethane | .600 | ug/L |

ATG = ANALYTICAL TEST GROUP
RMDL = REGULATION METHOD OF DETECTION LIMIT

## Table A2.1
## Integrated Steel Mills

| ATG | PARAMETER | RMDL | UNIT |
|---|---|---|---|
| 16 | 1,1-Dichloroethane | .800 | ug/L |
| | 1,1-Dichloroethylene | 2.800 | ug/L |
| | 1,2-Dichlorobenzene | 1.400 | ug/L |
| | 1,2-Dichloroethane | .800 | ug/L |
| | 1,2-Dichloropropane | .900 | ug/L |
| | 1,3-Dichlorobenzene | 1.100 | ug/L |
| | 1,4-Dichlorobenzene | 1.700 | ug/L |
| | Bromoform | 3.700 | ug/L |
| | Bromomethane | 3.700 | ug/L |
| | Carbon Tetrachloride | 1.300 | ug/L |
| | Chlorobenzene | .700 | ug/L |
| | Chloroform | .700 | ug/L |
| | Chloromethane | 3.700 | ug/L |
| | Cis-1,3-Dichloropropylene | 1.400 | ug/L |
| | Dibromochloromethane | 1.100 | ug/L |
| | Ethylene Dibromide | 1.000 | ug/L |
| | Methylene Chloride | 1.300 | ug/L |
| | Tetrachloroethylene | 1.100 | ug/L |
| | Trans-1,2-Dichloroethylene | 1.400 | ug/L |
| | Trans-1,3-Dichloropropylene | 1.400 | ug/L |
| | Trichloroethylene | 1.900 | ug/L |
| | Trichlorofluoromethane | 1.000 | ug/L |
| | Vinyl Chloride | 4.000 | ug/L |
| 17 | Benzene | .500 | ug/L |
| | Ethylbenzene | .600 | ug/L |
| | Styrene | .500 | ug/L |
| | Toluene | .500 | ug/L |
| | m-Xylene and p-Xylene | 1.100 | ug/L |
| | o-Xylene | .500 | ug/L |
| 19 | 1-Chloronaphthalene | 2.500 | ug/L |
| | 1-Methylnaphthalene | 3.200 | ug/L |
| | 2,4-Dinitrotoluene | .800 | ug/L |
| | 2,6-Dinitrotoluene | .700 | ug/L |
| | 2-Chloronaphthalene | 1.800 | ug/L |
| | 2-Methylnaphthalene | 2.200 | ug/L |
| | 4-Bromophenyl Phenyl Ether | .300 | ug/L |
| | 4-Chlorophenyl Phenyl Ether | .900 | ug/L |
| | 5-Nitro, Acenaphthene | 4.300 | ug/L |
| | Acenaphthene | 1.300 | ug/L |

ATG = ANALYTICAL TEST GROUP
RMDL = REGULATION METHOD OF DETECTION LIMIT

## Table A2.1
## Integrated Steel Mills

| ATG | PARAMETER | RMDL | UNIT |
|---|---|---|---|
| 19 | Acenaphthylene | 1.400 | ug/L |
| | Anthracene | 1.200 | ug/L |
| | Benzo(a)anthracene | .500 | ug/L |
| | Benzo(a)pyrene | .600 | ug/L |
| | Benzo(b)fluoranthene | .700 | ug/L |
| | Benzo(g,h,i)perylene | .700 | ug/L |
| | Benzo(k)fluoranthene | .700 | ug/L |
| | Benzobutylphthalate | .600 | ug/L |
| | Bis(2-chloroethoxyl)methane | 3.500 | ug/L |
| | Bis(2-chloroethyl)ether | 4.400 | ug/L |
| | Bis(2-chloroisopropyl)ether | 2.200 | ug/L |
| | Bis(2-ethylhexyl)phthalate | 2.200 | ug/L |
| | Camphene | 3.500 | ug/L |
| | Chrysene | .300 | ug/L |
| | Di-n-butyl Phthalate | 3.800 | ug/L |
| | Di-n-octyl Phthalate | 2.000 | ug/L |
| | Dibenz(a,h)anthracene | 1.300 | ug/L |
| | Diphenylamine | 14.000 | ug/L |
| | Fluoranthene | .400 | ug/L |
| | Fluorene | 1.700 | ug/L |
| | Indeno(1,2,3-cd)pyrene | 1.300 | ug/L |
| | Indole | 1.900 | ug/L |
| | N-Nitrosodi-n-propylamine | 3.100 | ug/L |
| | N-Nitrosodiphenylamine | 14.000 | ug/L |
| | Naphthalene | 1.600 | ug/L |
| | Perylene | 1.500 | ug/L |
| | Phenanthrene | .400 | ug/L |
| | Pyrene | .400 | ug/L |
| 20 | 2,3,4,5-Tetrachlorophenol | .400 | ug/L |
| | 2,3,4,6-Tetrachlorophenol | 2.800 | ug/L |
| | 2,3,4-Trichlorophenol | .600 | ug/L |
| | 2,3,5,6-Tetrachlorophenol | 1.600 | ug/L |
| | 2,3,5-Trichlorophenol | 1.300 | ug/L |
| | 2,4,5-Trichlorophenol | 1.300 | ug/L |
| | 2,4,6-Trichlorophenol | 1.300 | ug/L |
| | 2,4-Dichlorophenol | 1.700 | ug/L |
| | 2,4-Dimethylphenol | 7.300 | ug/L |
| | 2,4-Dinitrophenol | 42.000 | ug/L |
| | 2,6-Dichlorophenol | 2.000 | ug/L |

ATG = ANALYTICAL TEST GROUP
RMDL = REGULATION METHOD OF DETECTION LIMIT

## Table A2.1
## Integrated Steel Mills

| ATG | PARAMETER | RMDL | UNIT |
|---|---|---|---|
| 20 | 2-Chlorophenol | 3.700 | ug/L |
| | 4,6-Dinitro-o-cresol | 24.000 | ug/L |
| | 4-Chloro-3-methylphenol | 1.500 | ug/L |
| | 4-Nitrophenol | 1.400 | ug/L |
| | Pentachlorophenol | 1.300 | ug/L |
| | Phenol | 2.400 | ug/L |
| | m-Cresol | 3.400 | ug/L |
| | o-Cresol | 3.700 | ug/L |
| | p-Cresol | 3.500 | ug/L |
| 23 | 1,2,3,4-Tetrachlorobenzene | .010 | ug/L |
| | 1,2,3,5-Tetrachlorobenzene | .010 | ug/L |
| | 1,2,3-Trichlorobenzene | .010 | ug/L |
| | 1,2,4,5-Tetrachlorobenzene | .010 | ug/L |
| | 1,2,4-Trichlorobenzene | .010 | ug/L |
| | 2,4,5-Trichlorotoluene | .010 | ug/L |
| | Hexachlorobenzene | .010 | ug/L |
| | Hexachlorobutadiene | .010 | ug/L |
| | Hexachlorocyclopentadiene | .010 | ug/L |
| | Hexachloroethane | .010 | ug/L |
| | Octachlorostyrene | .010 | ug/L |
| | Pentachlorobenzene | .010 | ug/L |
| 24 | 2,3,7,8 TCDD | .020 | ng/L |
| | Octachlorodibenzo-p-dioxin | .030 | ng/L |
| | Octachlorodibenzofuran | .030 | ng/L |
| | Total H6CDD | .030 | ng/L |
| | Total H6CDF | .020 | ng/L |
| | Total H7CDD | .030 | ng/L |
| | Total H7CDF | .030 | ng/L |
| | Total PCDD | .020 | ng/L |
| | Total PCDF | .015 | ng/L |
| | Total TCDD | .020 | ng/L |
| | Total TCDF | .015 | ng/L |
| 25 | Oil and Grease | 1.000 | mg/L |
| 26 | Abietic Acid | 5.000 | ug/L |
| | Chlorodehydroabietic Acid | 5.000 | ug/L |
| | Dehydroabietic Acid | 5.000 | ug/L |
| | Isopimaric Acid | 5.000 | ug/L |
| | Levopimaric Acid | 5.000 | ug/L |
| | Neoabietic Acid | 5.000 | ug/L |
| | Oleic Acid | 5.000 | ug/L |
| | Pimaric Acid | 5.000 | ug/L |
| 27 | PCBT | .100 | ug/L |
| IS1 | Iron | .020 | mg/L |

ATG = ANALYTICAL TEST GROUP
RMDL = REGULATION METHOD OF DETECTION LIMIT

## Table A2.2
## Mini & Specialty Steel Mills

| ATG | PARAMETER | RMDL | UNIT |
|---|---|---|---|
| 3 | Hydrogen Ion (pH) | | |
| 4a | Ammonia plus Ammonium | .250 | mg/L |
| | Total Kjeldahl Nitrogen | .500 | mg/L |
| 4b | Nitrate+Nitrite | .250 | mg/L |
| 5a | DOC | .500 | mg/L |
| 5b | TOC | 5.000 | mg/L |
| 6 | Total Phosphorus | .100 | mg/L |
| 7 | Specific Conductance | 5.000 | uS/cm |
| 8 | Total Suspended Solids | 5.000 | mg/L |
| | Volatile Suspended Solids | 10.000 | mg/L |
| 9 | Aluminum | .030 | mg/L |
| | Beryllium | .010 | mg/L |
| | Cadmium | .002 | mg/L |
| | Chromium | .020 | mg/L |
| | Cobalt | .020 | mg/L |
| | Copper | .010 | mg/L |
| | Lead | .030 | mg/L |
| | Molybdenum | .020 | mg/L |
| | Nickel | .020 | mg/L |
| | Silver | .030 | mg/L |
| | Thallium | .030 | mg/L |
| | Vanadium | .030 | mg/L |
| | Zinc | .010 | mg/L |
| 10 | Antimony | .005 | mg/L |
| | Arsenic | .005 | mg/L |
| | Selenium | .005 | mg/L |
| 11 | Chromium (hexavalent) | .010 | mg/L |
| 16 | 1,1,2,2-Tetrachloroethane | 4.300 | ug/L |
| | 1,1,2-Trichloroethane | .600 | ug/L |
| | 1,1-Dichloroethane | .800 | ug/L |
| | 1,1-Dichloroethylene | 2.800 | ug/L |
| | 1,2-Dichlorobenzene | 1.400 | ug/L |
| | 1,2-Dichloroethane | .800 | ug/L |
| | 1,2-Dichloropropane | .900 | ug/L |
| | 1,3-Dichlorobenzene | 1.100 | ug/L |
| | 1,4-Dichlorobenzene | 1.700 | ug/L |
| | Bromoform | 3.700 | ug/L |
| | Bromomethane | 3.700 | ug/L |
| | Carbon Tetrachloride | 1.300 | ug/L |
| | Chlorobenzene | .700 | ug/L |
| | Chloroform | .700 | ug/L |

ATG = ANALYTICAL TEST GROUP
RMDL = REGULATION METHOD OF DETECTION LIMIT

## Table A2.2
## Mini & Specialty Steel Mills

| ATG | PARAMETER | RMDL | UNIT |
|---|---|---|---|
| 16 | Chloromethane | 3.700 | ug/L |
| | Cis-1,3-Dichloropropylene | 1.400 | ug/L |
| | Dibromochloromethane | 1.100 | ug/L |
| | Ethylene Dibromide | 1.000 | ug/L |
| | Tetrachloroethylene | 1.100 | ug/L |
| | Trans-1,2-Dichloroethylene | 1.400 | ug/L |
| | Trans-1,3-Dichloropropylene | 1.400 | ug/L |
| | Trichloroethylene | 1.900 | ug/L |
| | Trichlorofluoromethane | 1.000 | ug/L |
| | Vinyl Chloride | 4.000 | ug/L |
| 17 | Benzene | .500 | ug/L |
| | Ethylbenzene | .600 | ug/L |
| | Styrene | .500 | ug/L |
| | Toluene | .500 | ug/L |
| | m-Xylene and p-Xylene | 1.100 | ug/L |
| | o-Xylene | .500 | ug/L |
| 19 | 1-Chloronaphthalene | 2.500 | ug/L |
| | 1-Methylnaphthalene | 3.200 | ug/L |
| | 2,4-Dinitrotoluene | .800 | ug/L |
| | 2,6-Dinitrotoluene | .700 | ug/L |
| | 2-Chloronaphthalene | 1.800 | ug/L |
| | 2-Methylnaphthalene | 2.200 | ug/L |
| | 4-Bromophenyl Phenyl Ether | .300 | ug/L |
| | 4-Chlorophenyl Phenyl Ether | .900 | ug/L |
| | 5-Nitro, Acenaphthene | 4.300 | ug/L |
| | Acenaphthene | 1.300 | ug/L |
| | Acenaphthylene | 1.400 | ug/L |
| | Anthracene | 1.200 | ug/L |
| | Benzo(a)anthracene | .500 | ug/L |
| | Benzo(a)pyrene | .600 | ug/L |
| | Benzo(b)fluoranthene | .700 | ug/L |
| | Benzo(g,h,i)perylene | .700 | ug/L |
| | Benzo(k)fluoranthene | .700 | ug/L |
| | Benzobutylphthalate | .600 | ug/L |
| | Bis(2-chloroethoxyl)methane | 3.500 | ug/L |
| | Bis(2-chloroethyl)ether | 4.400 | ug/L |
| | Bis(2-chloroisopropyl)ether | 2.200 | ug/L |
| | Bis(2-ethylhexyl)phthalate | 2.200 | ug/L |
| | Camphene | 3.500 | ug/L |
| | Chrysene | .300 | ug/L |
| | Di-n-butyl Phthalate | 3.800 | ug/L |

ATG = ANALYTICAL TEST GROUP
RMDL = REGULATION METHOD OF DETECTION LIMIT

## Table A2.2
## Mini & Specialty Steel Mills

| ATG | PARAMETER | RMDL | UNIT |
|---|---|---|---|
| 19 | Di-n-octyl Phthalate | 2.000 | ug/L |
| | Dibenz(a,h)anthracene | 1.300 | ug/L |
| | Diphenylamine | 14.000 | ug/L |
| | Fluoranthene | .400 | ug/L |
| | Fluorene | 1.700 | ug/L |
| | Indeno(1,2,3-cd)pyrene | 1.300 | ug/L |
| | Indole | 1.900 | ug/L |
| | N-Nitrosodi-n-propylamine | 3.100 | ug/L |
| | N-Nitrosodiphenylamine | 14.000 | ug/L |
| | Naphthalene | 1.600 | ug/L |
| | Perylene | 1.500 | ug/L |
| | Phenanthrene | .400 | ug/L |
| | Pyrene | .400 | ug/L |
| 20 | 2,3,4,5-Tetrachlorophenol | .400 | ug/L |
| | 2,3,4,6-Tetrachlorophenol | 2.800 | ug/L |
| | 2,3,4-Trichlorophenol | .600 | ug/L |
| | 2,3,5,6-Tetrachlorophenol | 1.600 | ug/L |
| | 2,3,5-Trichlorophenol | 1.300 | ug/L |
| | 2,4,5-Trichlorophenol | 1.300 | ug/L |
| | 2,4,6-Trichlorophenol | 1.300 | ug/L |
| | 2,4-Dichlorophenol | 1.700 | ug/L |
| | 2,4-Dimethylphenol | 7.300 | ug/L |
| | 2,4-Dinitrophenol | 42.000 | ug/L |
| | 2,6-Dichlorophenol | 2.000 | ug/L |
| | 2-Chlorophenol | 3.700 | ug/L |
| | 4,6-Dinitro-o-cresol | 24.000 | ug/L |
| | 4-Chloro-3-methylphenol | 1.500 | ug/L |
| | 4-Nitrophenol | 1.400 | ug/L |
| | Pentachlorophenol | 1.300 | ug/L |
| | Phenol | 2.400 | ug/L |
| | m-Cresol | 3.400 | ug/L |
| | o-Cresol | 3.700 | ug/L |
| | p-Cresol | 3.500 | ug/L |
| 23 | 1,2,3,4-Tetrachlorobenzene | .010 | ug/L |
| | 1,2,3,5-Tetrachlorobenzene | .010 | ug/L |
| | 1,2,3-Trichlorobenzene | .010 | ug/L |
| | 1,2,4,5-Tetrachlorobenzene | .010 | ug/L |
| | 1,2,4-Trichlorobenzene | .010 | ug/L |
| | 2,4,5-Trichlorotoluene | .010 | ug/L |
| | Hexachlorobenzene | .010 | ug/L |
| | Hexachlorobutadiene | .010 | ug/L |

ATG = ANALYTICAL TEST GROUP
RMDL = REGULATION METHOD OF DETECTION LIMIT

# Table A2.2
## Mini & Specialty Steel Mills

| ATG | PARAMETER | RMDL | UNIT |
|---|---|---|---|
| 23 | Hexachlorocyclopentadiene | .010 | ug/L |
| | Hexachloroethane | .010 | ug/L |
| | Octachlorostyrene | .010 | ug/L |
| | Pentachlorobenzene | .010 | ug/L |
| 24 | 2,3,7,8 TCDD | .020 | ng/L |
| | Octachlorodibenzo-p-dioxin | .030 | ng/L |
| | Octachlorodibenzofuran | .030 | ng/L |
| | Total H6CDD | .030 | ng/L |
| | Total H6CDF | .020 | ng/L |
| | Total H7CDD | .030 | ng/L |
| | Total H7CDF | .030 | ng/L |
| | Total PCDD | .020 | ng/L |
| | Total PCDF | .015 | ng/L |
| | Total TCDD | .020 | ng/L |
| | Total TCDF | .015 | ng/L |
| 25 | Oil and Grease | 1.000 | mg/L |
| 27 | PCBT | .100 | ug/L |
| IS1 | Iron | .020 | mg/L |

ATG = ANALYTICAL TEST GROUP
RMDL = REGULATION METHOD OF DETECTION LIMIT

## Table A2.3
## Provincial Water Quality Objectives (PWQO)[21]

| ATG | PARAMETER | PWQO | INTERIM PWQO | UNIT |
|---|---|---|---|---|
| 9 | Aluminum | 0.015 | - | mg/L |
| | Beryllium | 11-1100[Note 1] | - | ug/L |
| | Cadmium | 0.2 | - | ug/L |
| | Cadmium (revised) | - | 0.1-0.5[Note1] | ug/L |
| | Chromium | 100 | - | ug/L |
| | Cobalt | - | 0.4 | ug/L |
| | Copper | 5 | - | ug/L |
| | Copper (revised) | - | 1-5[Note 1] | ug/L |
| | Lead | 5-25[Note 2] | - | ug/L |
| | Lead (revised) | - | 1-5[Note 1] | ug/L |
| | Molybdenum | - | 10 | ug/L |
| | Nickel | 25 | - | ug/L |
| | Silver | 0.1 | - | ug/L |
| | Thallium | - | 0.3 | ug/L |
| | Vanadium | - | 7.0 | ug/L |
| | Zinc | 30 | - | ug/L |
| | Zinc (revised) | - | 20 | ug/L |
| 10 | Antimony | - | 7 | ug/L |
| | Arsenic | 100 | - | ug/L |
| | Arsenic (revised) | - | 5 | ug/L |
| | Selenium | 100 | - | ug/L |
| 12 | Mercury | 0.2 | - | ug/L |
| 14 | Phenolics (4AAP) | 1 | - | ug/L |
| 16 | 1,1,2-Trichloroethane | - | 800 | ug/L |
| | 1,1-Dichloroethane | - | 200 | ug/L |
| | 1,1-Dichloroethylene | - | 40 | ug/L |
| | 1,2-Dichlorobenzene | 2.5 | - | ug/L |
| | 1,2-Dichloroethane | - | 100 | ug/L |
| | 1,2-Dichloropropane | - | 0.7 | ug/L |
| | 1,3-Dichlorobenzene | 2.5 | - | ug/L |
| | 1,4-Dichlorobenzene | 4 | - | ug/L |
| | Bromoform | - | 60 | ug/L |
| | Bromomethane | - | 0.9 | ug/L |
| | Chlorobenzene | 15 | - | ug/L |
| | Chloromethane | - | 700 | ug/L |
| | Ethylene Dibromide | - | 5 | ug/L |
| | Methylene Chloride | - | 100 | ug/L |
| | Tetrachloroethylene | - | 50 | ug/L |
| | Trans-1,2-Dichloroethylene | - | 200 | ug/L |
| | Trans-1,3-Dichloropropylene | - | 7 | ug/L |
| | Trichloroethylene | - | 20 | ug/L |
| | Vinyl Chloride | - | 600 | ug/L |
| 17 | Benzene | - | 100 | ug/L |
| | Ethylbenzene | - | 8 | ug/L |

## Table A2.3
## Provincial Water Quality Objectives (PWQO)

| ATG | PARAMETER | PWQO | INTERIM PWQO | UNIT |
|---|---|---|---|---|
| 17 | Styrene | - | 4 | ug/L |
| | Toluene | - | 0.8 | ug/L |
| | m-Xylene | - | 2 | ug/L |
| | o-Xylene | - | 40 | ug/L |
| | p-Xylene | - | 30 | ug/L |
| 19 | 1-Chloronaphthalene | - | 0.1 | ug/L |
| | 1-Methylnaphthalene | - | 2 | ug/L |
| | 2,4-Dinitrotoluene | - | 4 | ug/L |
| | 2,6-Dinitrotoluene | - | 3 | ug/L |
| | 2-Chloronaphthalene | - | 0.2 | ug/L |
| | 2-Methylnaphthalene | - | 2 | ug/L |
| | 4-Bromophenyl Phenyl Ether | - | 0.05 | ug/L |
| | 4-Chlorophenyl Phenyl Ether | - | 0.05 | ug/L |
| | Anthracene | - | 0.0008 | ug/L |
| | Benzo(a)anthracene | - | 0.0004 | ug/L |
| | Benzo(a)pyrene | - | 0.21 | ug/L |
| | Benzo(g,h,i)perylene | - | 0.00002 | ug/L |
| | Benzo(k)fluoranthene | - | 0.00002 | ug/L |
| | Bis(2-chloroethyl)ether | - | 200 | ug/L |
| | Camphene | - | 2 | ug/L |
| | Chrysene | - | 0.0001 | ug/L |
| | Dibenz(a,h)anthracene | - | 0.002 | ug/L |
| | Fluoranthene | - | 0.0008 | ug/L |
| | Fluorene | - | 0.2 | ug/L |
| | N-Nitrosodiphenylamine | - | 7 | ug/L |
| | Naphthalene | - | 7 | ug/L |
| | Perylene | - | 0.00007 | ug/L |
| | Phenanthrene | - | 0.03 | ug/L |
| 20 | 2,3,4,5-Tetrachlorophenol | 1 | - | ug/L |
| | 2,3,4,6-Tetrachlorophenol | 1 | - | ug/L |
| | 2,3,4-Trichlorophenol | 18 | - | ug/L |
| | 2,3,5,6-Tetrachlorophenol | 1 | - | ug/L |
| | 2,3,5-Trichlorophenol | 18 | - | ug/L |
| | 2,4,5-Trichlorophenol | 18 | - | ug/L |
| | 2,4,6-Trichlorophenol | 18 | - | ug/L |
| | 2,4-Dichlorophenol | 0.2 | - | ug/L |
| | 2,4-Dimethylphenol | - | 10.5 | ug/L |
| | 2,6-Dichlorophenol | 0.2 | - | ug/L |
| 20 | 4,6-Dinitro-o-cresol | - | 0.2 | ug/L |
| | 4-Chloro-3-methylphenol | - | 3 | ug/L |
| | 4-Nitrophenol | - | 48 | ug/L |
| | Pentachlorophenol | 0.5 | - | ug/L |
| | Phenol | - | 5 | ug/L |
| | m-Cresol | - | 1 | ug/L |
| | o-Cresol | - | 1 | ug/L |

## Table A2.3
## Provincial Water Quality Objectives (PWQO)

| ATG | PARAMETER | PWQO | INTERIM PWQO | UNIT |
|---|---|---|---|---|
| 20 | p-Cresol | - | 1 | ug/L |
| 23 | 1,2,3,4-Tetrachlorobenzene | 0.1 | - | ug/L |
| | 1,2,3,5-Tetrachlorobenzene | 0.1 | - | ug/L |
| | 1,2,3-Trichlorobenzene | 0.9 | - | ug/L |
| | 1,2,4,5-Tetrachlorobenzene | 0.15 | - | ug/L |
| | 1,2,4-Trichlorobenzene | 0.5 | - | ug/L |
| | Hexachlorobenzene | 0.0065 | - | ug/L |
| | Hexachlorobutadiene | - | 0.07 | ug/L |
| | Hexachlorocyclopentadiene | - | 0.07 | ug/L |
| | Hexachloroethane | - | 0.5 | ug/L |
| | Pentachlorobenzene | 0.03 | - | ug/L |
| 24 | Dibenzofuran | - | 0.3 | ug/L |
| 26 | Oleic Acid | - | 1 | ug/L |
| 27 | PCBT | 0.001 | - | ug/L |
| IS1 | Iron | 300 | - | ug/L |

PWQO = Provincial Water Quality Objectives

Note 1: Parameters for which PWQO is dependent on hardness.

| PARAMETER | HARDNESS (mg/L) | PWQO (ug/L) | INTERIM PWQO (ug/L) |
|---|---|---|---|
| Beryllium | < 75 | 11 | - |
| | > 75 | 1100 | - |
| Cadmium (revised) | 0 - 100 | | 0.1 |
| | > 100 | | 0.5 |
| Copper (revised) | 0 - 20 | | 1 |
| | > 20 | | 5 |
| Lead (revised) | < 30 | | 1 |
| | 30 - 80 | | 3 |
| | > 80 | | 5 |

Note 2: Parameters for which PWQO is dependent on alkalinity.

| PARAMETER | ALKALINITY AS $CaCO_3$ (mg/L) | PWQO (ug/L) |
|---|---|---|
| Lead | <20 | 5 |
| | 20 to 40 | 10 |
| | 40 to 80 | 20 |
| | >80 | 25 |

**REFERENCE:** **"Water Management - Policies, Guidelines, Provincial Water Quality Objectives of the Ministry of Environment and Energy - July 1994".**

# Appendix III
# Summary of the U.S. EPA Approach for the Selection of BAT Models

The following summary outlines the BAT treatment models that were considered by the U.S.EPA and the selected model that was used in the effluent limits development for each process subcategory except the finishing operations. As indicated earlier, the approach used by Ontario regulation for the finishing process subcategory is different from that used by the U.S.EPA.

## A3.1 Cokemaking

Fifty-eight by-product cokemaking plants were requested to provide information about production processes and rates, process water usage and discharge rates, wastewater treatment and disposal methods, age of plants and treatment systems. In addition, nine plants were sampled.

Four BAT treatment alternatives were considered for by-product cokemaking:

1. The wastewater is treated in a single or two-staged biological system (complete with a separate clarifier after each stage).

2. Filtration of the effluent from the first BAT alternative to minimize the carry over of suspended solids and toxic contaminants that may be entrained in the solids.

3. Addition of powdered activated carbon to the biological reactors.

4. The treated effluent from the biological system is disposed of by quenching.

The Agency selected the BAT alternative No. 1 as the model treatment system since it was installed and practised on a full scale at four by-product coke plants. However, all of the biological systems at these four plants were not operated to achieve BAT limits. In making the selection, the Agency considered the separation of process wastewaters from non-contact cooling waters; recycle of final cooler waters; recycle of emission control wastewaters; processing of excess ammonia liquor and other wastewaters in free and fixed ammonia stills; hydraulic and waste loading equalization.

The Agency did not select BAT alternative No. 2 since the overall performance of the filtration system was not satisfactory because of design and mechanical problems. BAT alternative No. 3 was not selected due to short-term testing of the powdered activated carbon on a pilot scale basis. This technology, however, indicated a potential for reductions in total pollutant loads. Alternative No. 4 was not selected because of air pollution.

Based on the performance of several well operated plants, the Agency found that a flow of 153 gal/ton of coke represents a basic BAT flow. This flow includes 50 gal/ton as a dilution water to optimize bio-oxidation.

Flow allowances of 85 gal/ton are added to the basic flow rate for qualified desulphurizers (25 gal/ton) and for indirect ammonia recovery (60 gal/ton).

Pollutants limited under BAT are Ammonia, Cyanide, Phenols (4AAP), Benzene, Naphthalene and Benzo(a)pyrene. Limits for ammonia, cyanide and phenols (4AAP) were expressed as maximum loading (mass per unit production) for any one day as well as average loading of daily values for 30 consecutive days. Limits for benzene, naphthalene and benzo(a)pyrene are expressed only as maximum loading for any one day. The regulation allows an increase of 16% when desulphurizers are used and an increase of 39% of the limits when indirect ammonia recovery is practised.

## A3.2 Sintering

The Agency selected the plants that have a recycle rate of 92% and an effluent flow of 120 gal/ton as BAT plants. In the selection process the Agency considered the following treatment alternative for the 120 gal/ton blowdown:

1. Filtration and pH adjustment of the effluent using acid.

2. Lime precipitation and sedimentation and pH control.

3. Lime precipitation and sedimentation followed by two-stage alkaline chlorination for the purpose of oxidizing cyanide, phenols and other toxic organic pollutants. The chlorinated effluent is dechlorinated with an appropriate reducing agent prior to discharge.

4. The chlorinated effluent is filtered and then followed by adsorption on granular activated carbon for removal of toxic organic pollutants.

5. Zero discharge is achieved by evaporating the blowdown and returning all the condensate to the process.

The Agency selected BAT alternative No. 1 since the relatively low levels of pollutants do not warrant the application of more advanced technologies. Pollutants limited are ammonia, cyanide, phenols (4AAP), total residual chlorine, lead and zinc. With the exception of total residual chlorine, limits are expressed as a maximum loading of any one day as well as average daily loading values for 30 consecutive days.

## A3.3 Ironmaking

A total of fifty-four plants were requested to provide information, on process of blast furnaces and treatment of the blowdown of gas cleaning.

The Agency found that well operated plants can achieve a discharge flow of 70 gal/ton of blast furnace recycle systems.

The BAT alternatives for the treatment of the 70 gal/ton blowdown are:

1. Increase the recycle rate to the point where it [the blowdown] can be consumed in the quenching of the blast furnace slag. The treatment system includes a slag pit collection and recycle sump. As all of the blowdown is evaporated, process wastewater pollutants are not discharged into receiving waters.

2. Pressure filters are used to reduce toxic metals.

3. Lime precipitation and sedimentation.

4. Lime precipitation, inclined plate separator followed by two-stage alkaline chlorination.

5. The effluent from BAT 4 is treated by adsorption on activated carbon.

6. Zero discharge is achieved by vapour compression distillation. The condensate is returned to the recycle system.

The Agency selected BAT alternative No. 4 since it was demonstrated at one plant and pilot studies. While BAT alternative No. 1 is the least expensive alternative and achieves the highest degree of treatment (i.e. no discharge to receiving waters), the Agency did not select this alternative due to the methods of slag handling (i.e. remote from the blast furnace).

BAT effluent limits, expressed as maximum loading as well as average loading, are set for ammonia, cyanide, phenols (4AAP), lead and zinc. Total residual chlorine is expressed as maximum loading.

## A3.4 Steelmaking

The Agency identified three BAT alternative treatment systems to be applied to the blowdown of the recirculated gas cleaning wastewaters (greater than 90% is recirculated):

1. Filtration and addition of acid to control the pH of the treated effluent. Filtration will remove those toxic metals that are in particulate form. This technology is demonstrated at one plant.

2. Lime addition, gravity sedimentation and a final pH adjustment of the treated effluent. This technology removes both dissolved and particulate toxic metals. The capabilities of lime addition and precipitation have been demonstrated at two plants.

3. Evaporation, condensation and return to the process. The residue is dried and landfilled. A zero discharge is to be achieved, however, zero discharge has not been reported at any of the steelmaking operations.

The Agency selected BAT alternative No. 2 as the BAT model treatment system for the steelmaking operations. The selection process included a review of the toxicity levels of each pollutant considered for limitation at BAT, the effluent levels of these pollutants in each treatment alternative, and the costs of each alternative.

Based on these considerations, the Agency determined that the selected BAT alternative provides the most significant benefits with regard to reductions in toxic pollutant effluent loads. Alternative No. 1 was not selected since it was not capable of removing dissolved toxic metals pollutants in steelmaking wastewaters. Alternative No. 3 was not selected since the incremental toxic pollutant reduction from alternative No. 2 to zero discharge does not justify the high costs.

A flow of 110 gal/ton is considered a BAT effluent flow and is representative of properly designed and operated treatment systems in the steelmaking subcategory. This BAT flow rate is demonstrated at a number of steelmaking operations with recycle systems. The Agency did not recommend lower rates because of the potential of fouling and scaling problems.

Limits were promulgated for total suspended solids, lead, zinc and pH. With the exception of pH, limits are expressed as maximum daily as well as average loading.

## A3.5 Vacuum Degassing

Vacuum degassing is the process of removing gases (principally hydrogen, oxygen and nitrogen) from molten steel under a vacuum to produce steel of high standards. Steam jet ejectors are commonly used to generate the vacuum for the vacuum degassing units. Barometric condensers are used to condense the steam used in the ejectors.

The Agency developed the following model treatment as an add-on to the BPT model treatment system which consists of scale pits, cooling towers, and recycle systems where most of the process wastewaters following sedimentation in a scale pit, are recycled through a cooling tower to the process; the remaining process wastewaters (25 gal/ton) are discharged as blowdown.

The BAT alternatives are:

1. Filtration of the BPT treatment blowdown of 25 gal/ton.

2. Lime precipitation, sedimentation, and pH control.

3. Vapours compression distillation to achieve zero discharge.

The Agency selected BAT alternative No. 2 since it provides the most significant benefits with regard to reductions in toxic pollutant effluent loads. Alternative No. 1 was not selected because it does not remove those toxic metals that are dissolved in the wastewaters. Alternative No. 3 was not selected on the basis of its high cost and high energy consumption. Limits were promulgated for pH, suspended solids, lead and zinc and expressed as maximum loading for any one day as well as average loading of daily values for 30 consecutive days.

## A3.6 Continuous Casting

An integral part of the steelmaking process is the conversion of molten steel into a semi-finished product or shape that is suitable for further processing. The process continuously casts the molten steel produced in the steelmaking processes through water cooled copper molds to produce desired semi-finished products. During the continuous casting process, as the semi-solidified steel emerges from the molds, water is sprayed onto the product for further cooling. This results in process wastewaters which require treatment prior to discharge.

The Agency adopted the BPT treatment model for the BAT treatment system. This treatment system consists of a scale pit with Drag Tank and surface skimming followed by flat bed filter. Ninety-six percent of the filter effluent is returned to the process.

Lime precipitation and sedimentation of the blowdown is used to remove both particulate and dissolved toxic metals. The rate of blowdown for the treatment system is 25 gal/ton. Limits for suspended solids, oil and grease, lead, zinc and pH are expressed as daily and average loading.

The Agency selected the above treatment system which is similar to that selected for steelmaking and vacuum degassing to facilitate central treatment of these process subcategories. The Agency did not select filtration nor vapour compression distillation since the former cannot remove dissolved pollutants and the latter is costly.

## A3.7 Hot Forming

Hot forming is the process in which hot steel, initially in solid ingot form or in intermediate shapes, is reduced in cross-section through a series of forming steps, ultimately producing finished and semi-finished steel product. Hot forming processes can be grouped into primary mills (slab and bloom), section mills (billet, bar, rod, small structural and large structural), flat mills (plate and hot strip), and pipe and tube mills (seamless pipe and butt weld pipe). A total of 101 hot forming operations were sampled to obtain process information and wastewater quality data.

The BPT model treatment system consists of a scale pit where large particles settle out and surface skimmers remove floating oils, recycle system with partial recycle (58% to 77%, depending on the type of hot forming) of the scale pit effluent is recirculated to the mill, clarification and filtration to treat the remaining wastewater effluent for additional removal of suspended solids and oil, a vacuum filter is used to dewater the under flow from the clarifier.

The BPT model flows are as follows:

| | |
|---|---|
| Primary with scarfer | 897 gal/ton |
| Primary without scarfer | 1326 gal/ton |
| Section - carbon | 2141 gal/ton |
| Section - specialty | 1344 gal/ton |
| Flat - hot strip | 2560 gal/ton |
| Flat - plate carbon | 1360 gal/ton |
| Flat - plats specialty | 600 gal/ton |
| Pipe and tube | 1270 gal/ton |

Two BAT alternatives were investigated by the Agency:

1. The BPT effluent is recycled such that an overall 96% recycle rate is achieved.

2. Zero discharge is achieved by evaporating and condensing the effluent from alternative 1 with the condensate returned to the process water system.

The Agency determined that although a recycle rate of 96% was achievable, it was not warranted for toxic metals control beyond that provided by the model BPT treatment system. BPT limits were set for total suspended solids, oil and grease, lead and zinc. Based on a review and update of all forming operations the Agency has determined that about 75% of the hot forming operations are currently in compliance with the BPT effluent limits.

# Appendix IV
# Economic Assessment

## A4.1 Cost Analysis Of BAT Options

Two analytical techniques were applied to analyze the costs of potential abatement technology options postulated for each firm. The first technique involves derivation of least-cost abatement cost functions for each firm. The second analytical technique is the application of cost-effectiveness analysis to calculate the unit and marginal costs associated with each level of abatement and to identify which levels have the lowest of these measures.

## A4.2 Abatement Cost Functions

In order to compare and aggregate costs of various BAT Options at each firm, one-time capital costs are annualized and added to recurring (annual) "operating and maintenance" costs[2]. In this report, capital costs are annualized over ten years for each firm. A nominal or current (not adjusted for inflation) interest rate of 12% is used in all calculations.

Abatement cost functions show capital, annual operating and total annualized costs associated with levels of potential contaminant reductions. These estimates can be displayed in graphic or tabular formats. Abatement cost functions can be generated for individual plants or for the entire sector.

To derive least-cost abatement cost functions for each firm, total annualized (amortized capital plus annual operation and maintenance costs) BAT option costs are graphed against aggregate reductions or final loadings at each firm by BAT Option. This comparison is required to show how different BAT Options identified for each firm achieve successively higher levels of

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[2] The general annualization formula is:

$$\mathbf{TAC} = \{\mathbf{O\&M} * (1-\mathbf{T})\} + \{\mathbf{K} * (\mathbf{i}/[1-(\mathbf{i}+1)-\mathbf{n}]) * (1-\mathbf{T})\}$$

Where:
**TAC** ($/yr) = Total Annualized Cost
**O&M** ($/yr) = Operating, Maintenance and Administrative Costs
**K** ($) = Capital Cost
**T** (T/100) = Applicable Tax Rate
**i** (i/100) = Nominal Interest Rate
**n** (years) = Life of Abatement Equipment or System.

When T = 0, TAC represents the "before-tax" cost of the BAT Option which is also the cost to society; when T > 0, TAC represents "after-tax" cost which is borne by the polluter.

contaminant reduction. Also, where more than one BAT option produces similar reductions at different costs, the BAT option that yields a given contaminant reduction for the lowest cost is used to derive the Least-Cost Abatement Cost Functions.

Cost functions can show clearly the lowest cost at which a given abatement objective or contaminant reduction goal can be achieved. In cases where only a limited number of abatement technologies are postulated, a specified loading limit or target reduction must be achieved by implementing the next technology combination which removes larger quantities of pollutant than that required by the loading objective.

**Figure A4.1**, **Figure A4.2** and **Figure A4.3** show the abatement cost functions for Algoma, Dofasco and Stelco, respectively. The many technology combinations considered are shown as points on the graphs.

The two polar benchmarks or loci on the abatement cost functions are:

1. The "initial or baseline loading of contaminants to be reduced. At this baseline loading, no incremental abatement cost is incurred.

2. The "maximum technically achievable" level of abatement is the level at which the largest possible contaminant reduction can be attained at least cost.

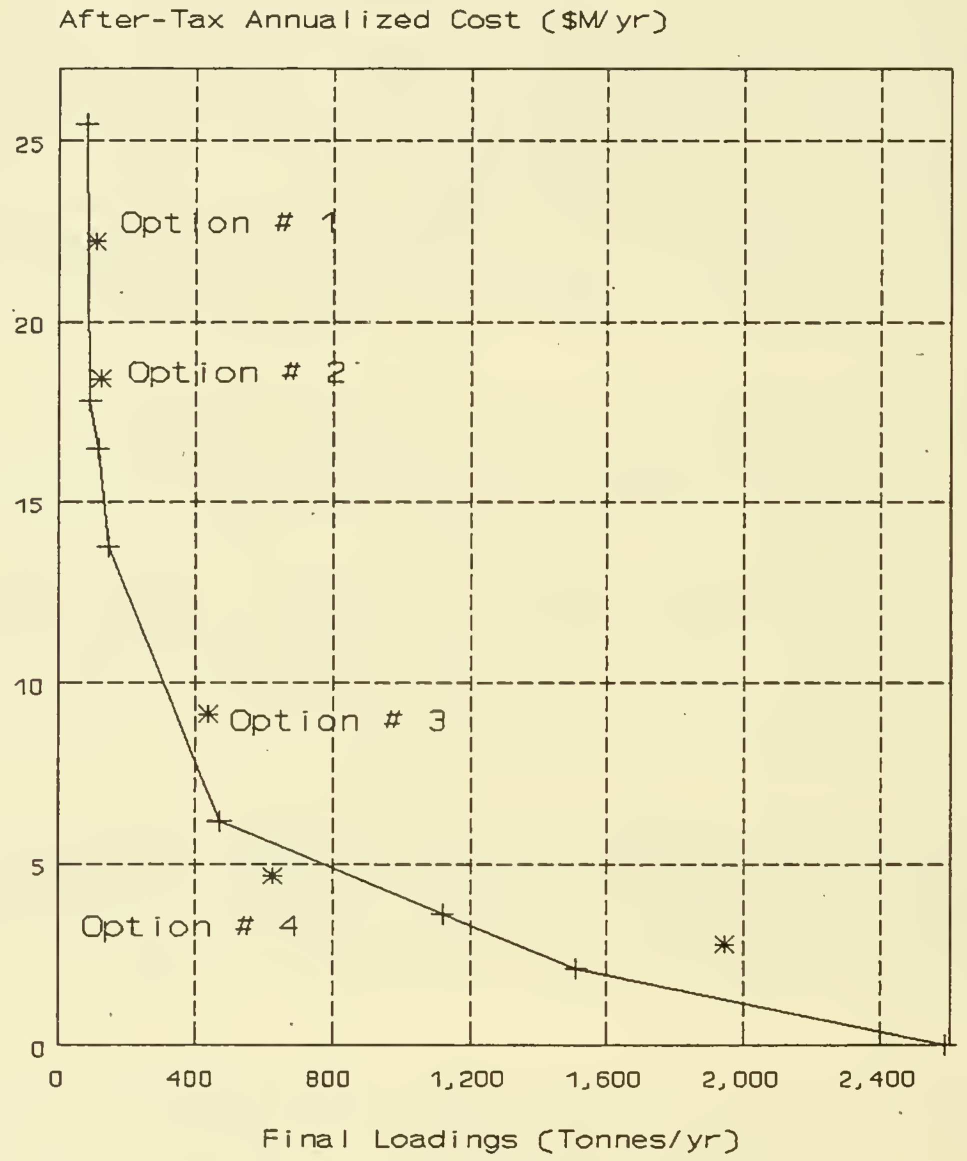
## A4.3 Cost-Effectiveness Analysis

Cost-effectiveness analysis facilitates comparison of the economic efficiency of different BAT Options. Cost-effectiveness analysis involves computing average cost per unit of pollutant removed or the ratio of incremental cost per incremental unit of pollutant reduced.

The average unit cost is calculated with the following equation:

**Unit Cost of Removal**($/kg) = [**Annualized Cost** ($/yr)]/[**Total Annual Reduction** (kg/yr)]

Marginal costs are a second order differentiation beyond average or unit costs and identify those technology combinations for which costs start to rise faster than contaminant reductions. Marginal cost per incremental reduction is calculated as follows:



Contaminants include: TSS, Oil & Grease, Cyanide, Ammonia, Phenolics, Lead, Zinc, Benzene, Benzo(a)pyrene, and Naphthalene

Figure A4.1: Abatement Cost Function For Algoma Comparing Total Annualized Costs of BAT Options with Initial and Final Loadings for Total Contaminants

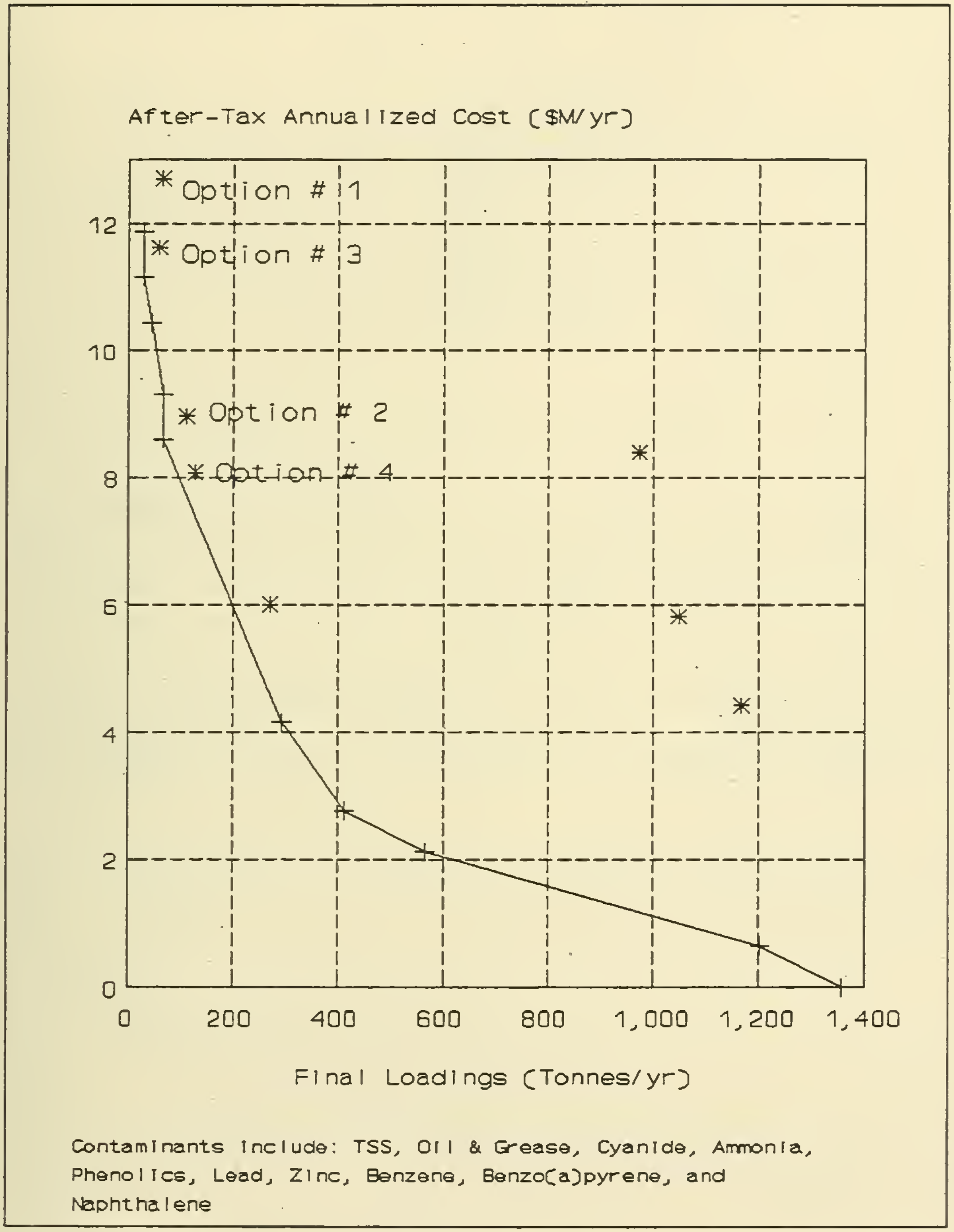


Figure A4.2: Abatement Cost Function for Dofasco Comparing Total Annualized Costs of BAT Options with Initial and Final Loadings for Total Contaminants

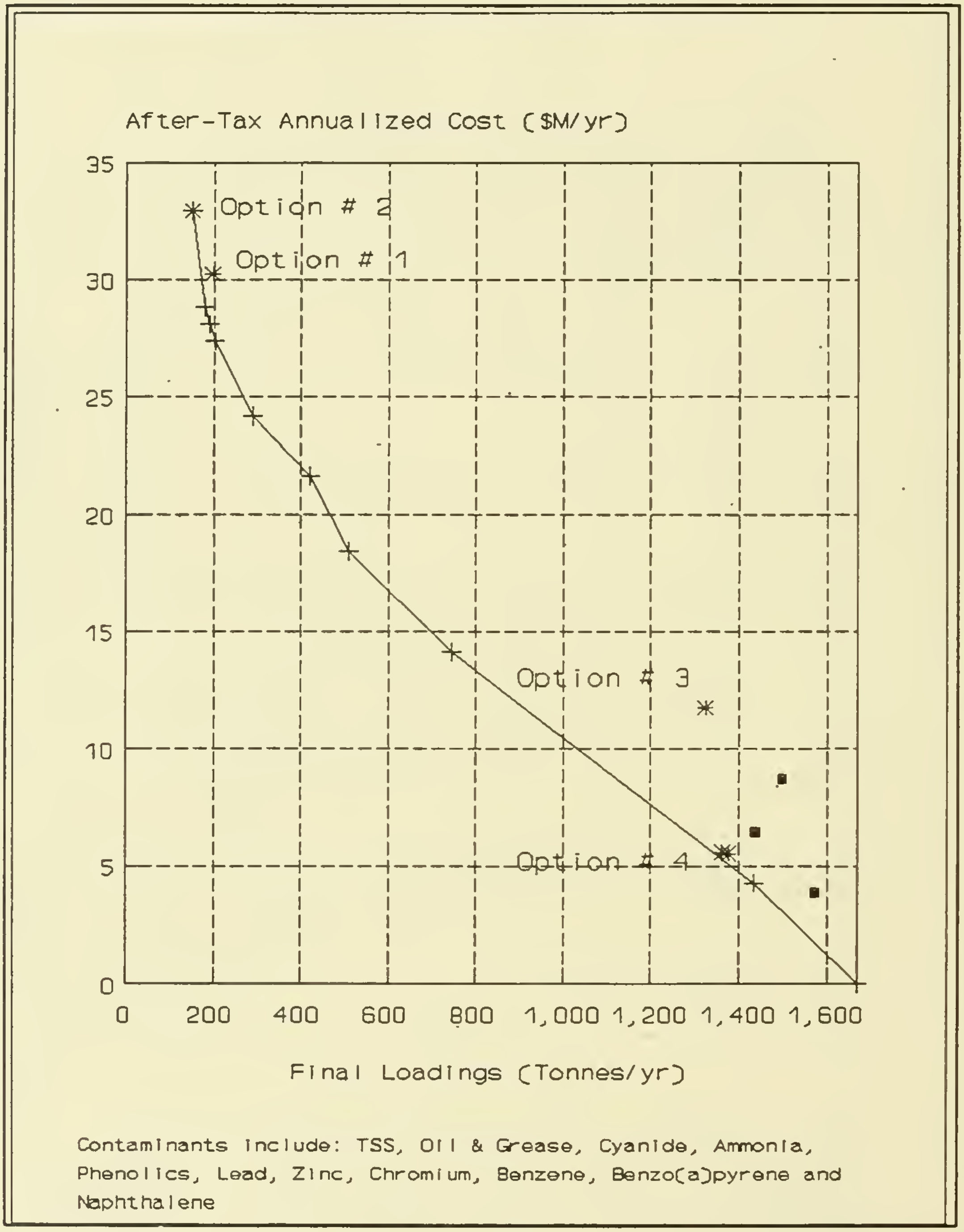


Figure A4.3: Abatement Cost Function for Stelco Hilton Works Comparing Total Annualized Costs of BAT Options with Initial and Final Loadings for Total Contaminants

**Marginal Cost of Removal** $(\Delta\$/\Delta kg) = [(\Delta\$/yr)/(\Delta kg/yr)] = [(C_2 - C_1)/(L_2 - L_1)]$

Where: $C_1$ = Total annualized cost of BAT Option "i" (BAT Option "1")
$C_2$ = Total annualized cost of the next higher BAT Option "i+1" (BAT Option "2")
$L_1$ = Loading reduction achieved by BAT Option "i" (BAT Option "1")
$L_2$ = Loading reduction achieved by the next higher BAT Option "i+1" (Option "2" )

## A4.4 Results of the Cost-Effectiveness Analyses

**Ontario Integrated Steel Mills**
The results of the cost-effectiveness analyses for Algoma, Dofasco and Stelco-Hilton are provided in **Table A4.1**, which shows that BAT Option 4 is the most cost-effective BAT Option for all firms.

In the case of Algoma, the most cost-effective BAT Option could remove 76% of the total contaminant loading at a cost of $26.75 million in capital cost, $3.5 million/year in operating and maintenance costs and $4.7 million/year in after-tax annualized costs. The unit cost of this BAT Option is $2.39/kg.

The most cost-effective BAT Option postulated for Dofasco potentially could reduce total contaminants loadings by 91% at $6.56/kg. The total costs of this BAT Option is estimated to be $50 million in capital cost, $4.6 million in operating and maintenance costs and an after-tax annualized cost of $8.1 million/year.

The most cost-effective BAT Option postulated for Stelco-Hilton could remove 18% of the total contaminant loadings for a cost of $40.1 million in capital cost, $2.8 million/year in operating and maintenance costs, and an after-tax annualized cost of $5.6 million/year. The unit cost of this BAT Option is calculated to be $18.22/kg.

**Ontario Non-Integrated Steel Mills**

The most cost-effective BAT Options for the non-integrated steel mills, Atlas, Ivaco and Lasco are shown in **Table A4.2**. For these firms, "BAT Option 3" was assessed as the most cost-effective. BAT Option 3 could remove 60% of the total contaminant loadings at Atlas at cost of $0.35 million in capital cost, $0.08 million/year in operating and maintenance costs and $0.14 million/year in after-tax annualized cost. This BAT Option would cost $4.85/kg of contaminant removed.

It is estimated that 82% of the total contaminant loading at Lasco could be removed through application of BAT Option 3. The abatement cost to the Lasco is estimated at $0.75 million in capital cost, $0.15 in operating and maintenance costs and $0.17 million in after-tax annualized cost. The unit cost of this BAT Option is calculated at $6.81/kg.

In the case of Ivaco, "BAT Option 3" was postulated as a fail-safe option since no process effluent was discharged during the MISA-monitoring phase and the firm finds it difficult to maintain that level of performance on a continuous basis. The costs to Ivaco to install this BAT Option are estimated at $0.5 million in capital, $0.15 million/year in operating and maintenance costs and $0.14 million/year in after-tax annualized cost.

The calculated marginal costs show that among integrated mills, Algoma, Dofasco and Stelco, the cost of removing an additional kilogram of contaminant at higher levels of abatement rise fastest at Stelco and slowest at Algoma. In the case of the non-integrated steel mills, Atlas, Ivaco and Lasco, the results are not definitive because of the small number of technically feasible BAT Options considered. However, between Atlas and Lasco it appears that abatement costs would rise faster at Atlas than at Lasco.

# Table A4.1
## Ontario Integrated Steel Mills: BAT Options, Reductions, Total and Unit Costs

| Firm<br>BAT Option | BAT Option Costs | | | Initial and Final Contaminant Loadings (kg/yr) | Total Contaminant Reduced (kg/yr) | Unit (Average) Contaminant Reduction Cost ($/kg) | Marginal Cost (Δ$/Δyr) |
|---|---|---|---|---|---|---|---|
| | Capital ($'M) | O&M ($'M/yr) | After-Tax Annualized Cost ($'M/yr) | | | | |
| **Algoma** | | | | 2,585,467 | | | |
| Option 1 | 112.24 | 18.64 | 22.22 | 105,896 | 2,479,571 | 8.96 | 244.23 |
| Option 2 | 94.26 | 15.25 | 18.41 | 121,496 | 2,463,971 | 7.47 | 29.59 |
| Option 3 | 50.54 | 7.01 | 9.15 | 434,446 | 2,151,021 | 4.25 | 23.75 |
| Option 4 | 26.75 | 3.5 | 4.70 | 621,799 | 1,963,668 | 2.39 | 2.39 |
| **Dofasco** | | | | 1,356,921 | | | |
| Option 1 | 70.21 | 9.71 | 12.70 | 64,408 | 1,292,513 | 9.83 | -165.49 |
| Option 2 | 56.25 | 5.80 | 8.96 | 110,604 | 1,246,317 | 7.19 | 53.35 |
| Option 3 | 65.41 | 8.70 | 11.62 | 57,882 | 1,299,039 | 8.95 | 50.45 |
| Option 4 | 50.00 | 4.60 | 8.07 | 127,285 | 1,229,636 | 6.56 | 6.56 |
| **Stelco-Hilton** | | | | 1,668,959 | | | |
| Option 1 | 164.79 | 23.45 | 30.21 | 197,311 | 1,471,648 | 20.53 | 16.37 |
| Option 2 | 182.13 | 25.14 | 32.91 | 152,151 | 1,516,808 | 21.70 | 59.79 |
| Option 3 | 66.51 | 8.78 | 11.77 | 1,323,721 | 345,238 | 34.09 | 162.62 |
| Option 4 | 40.10 | 2.8 | 5.60 | 1,361,647 | 307,312 | 18.22 | 18.22 |

## Table A4.2
## Ontario Non-Integrated Steel Mills: BAT Options, Reductions, Total and Unit Costs

| Firm<br>BAT Options | BAT Option Costs | | | Initial and Final Contaminant Loadings (kg/yr) | Total Contaminant Reduced (kg/yr) | Unit (Average) Contaminant Reduction Cost ($/kg) | Marginal Cost (Δ$/Δyr) |
|---|---|---|---|---|---|---|---|
| | Capital ($'M) | O&M ($'M/yr) | After-Tax Annualized Cost ($'M/yr) | | | | |
| **Atlas** | | | | 31,180 | | | |
| Option 2 | 6.24 | 0.86 | 1.13 | 1,380 | 29,800 | 37.92 | 92.53 |
| Option 3 | 0.35 | 0.08 | 0.09 | 12,619 | 18,561 | 4.85 | 4.85 |
| **Ivaco** | | | | 0* | | | |
| Option 1 | 0.21 | 0.07 | 0.05 | 5,051 | (5,051) | -- | -- |
| Option 2 | 2.22 | 0.66 | 0.63 | 0 | 0 | 0 | -- |
| Option 3 | 0.50 | 0.15 | 0.14 | 5,697 | (5,697) | -- | -- |
| **Lasco** | | | | 30,569 | | | |
| Option 1 | 0.21 | 0.074 | 0.07 | 9,402 | 21,167 | 3.31 | 3.31 |
| Option 2 | 2.20 | 0.71 | 0.40 | 0 | 30,569 | 13.09 | 40.93 |
| Option 3 | 0.75 | 0.15 | 0.17 | 5,620 | 24,949 | 6.81 | 26.44 |

* No process effluent was discharged during MISA monitoring period

## A4.5 Financial Assessments and Effects of BAT Option Costs on Iron and Steel Firms

Consistent with the draft Issue Resolution Process Final Report Summary (September 1991)[2], published financial data for the previous ten-years were used to determine the firms' average performance and to assess the potential financial effects of postulated BAT Option costs for the respective firms.

The 10-year average performance and that of the latest year for which financial data are available, were adjusted with the estimated costs of the most cost-effective BAT Options of sector firms. The adjusted financial statements of the firms were used to calculate nineteen different financial indices that are measures of financial performance. Five of these measures - "net income," "return on capital," "debt equity ratio", "cash flow to debt" and "capital investment" were selected and used to estimate the financial effects of the BAT Option costs. The adjustments also incorporated the mitigating effects of the income tax system and the Accelerated Capital Cost Allowance (ACCA). It is assumed that over a 3-year period, if a firm has profits against which to claim the ACCA for pollution abatement equipment, it can do so at the rate of 25% in Year 1, 50% in Year 2, and 25% in Year 3.

These financial assessments were done at the corporate level for the following reasons:

1. Intra-company transfer prices (that are prices charged to one division/plant of a company by another division/plant of the same company) for a particular plant may not reflect true market conditions;
2. Corporate resources may be available that are not recorded in plant level income statements;
3. The company, rather than the plant, would have to raise the funds for implementing regulatory requirements; and
4. Plant level financial data are not available.

## A4.6 Results of the Assessment of Potential Financial Effects of Postulated BAT Options

The potential effects of MISA BAT Option costs on the Ontario iron and steel sector are outlined **Table A4.3** and **Table A4.4**. The financial impact results for the most cost-effective BAT Options are discussed, first the effects on the firms' reported 10-year average performance (1983-1992). Second, the effects on the firms' 1992 performance, the latest year for which there are detailed financial data, is discussed. Note also that the after-tax impacts presented also incorporated the mitigating effect of the income tax system and Accelerated Capital Cost Allowance (ACCA).

### Table A4.3
### Financial Effects of MISA BAT Option Costs on Ontario Integrated Steel Mills

| Firm | BAT Options | Net Income After Taxes ($M) | Return on Capital (%) | Debt Equity Ratio | Cash Flow to Debt (%) |
|---|---|---|---|---|---|
| Algoma | Baseline: 10-yr Average | (114.7) | (5.9) | 1.2 | (7.5) |
| | Option 4 | (123.3) | (6.4) | 1.3 | (7.9) |
| | Baseline: 1992 | (74.1) | (10.9) | (3.1) | (5.6) |
| | Option 4 | (82.7) | (11.6) | (3.1) | (6.0) |
| Dofasco | Baseline: 10-yr Average | 28.9 | 6.3 | 0.5 | 6.3 |
| | Option 4 | 23.2 | 6.1 | 0.6 | 6.3 |
| | Baseline: 1992 | (207.1) | 5.9 | 0.8 | 6.3 |
| | Option 4 | (221.2) | 5.5 | 0.9 | 5.7 |
| Stelco-Hilton | Baseline: 10-yr Average | (8.3) | 1.9 | 0.6 | 5.8 |
| | Option 1 | (19.2) | 1.5 | 0.6 | 5.2 |
| | Baseline: 1992 | (127.0) | (4.5) | 1.0 | (6.0) |
| | Option 4 | (137.4) | (4.8) | 1.1 | (6.3) |

**Ten Year Average: 1983 - 1992**

When the 10-year average performance was adjusted with the BAT Option costs for the respective firms, changes to the financial performance indicators were small. For example, Dofasco's "return on investment" dropped by 0.2% from 6.3% to 6.1%. In the case of Stelco-Hilton, the drop was 0.4%, and for Algoma 0.5%. The results for the non-integrated steel mills show that the effects of the MISA costs were not large enough to show up as declines in "return on investment". For most of the firms, the added MISA costs did not change their "debt equity ratio". With the exception of Stelco-Hilton, only marginal changes occur to firms' after-tax net incomes. These results suggest that the MISA costs would only cause little declines in the firms' average financial performance.

## Table A4.4
## Financial Effects of MISA BAT Option Costs on Ontario Non-Integrated Steel Mills

| Firm | BAT Options | Net Income After Taxes ($M) | Return on Capital (%) | Debt Equity Ratio | Cash Flow to Debt (%) |
|---|---|---|---|---|---|
| Atlas | Baseline: 10-yr Average | (8.3) | (7.4) | <0.1 | (14.5) |
| | Option 4 | (8.4) | (7.5) | <0.1 | (14.7) |
| | Baseline: 1992 | (23.8) | (17.6) | <0.1 | (92.4) |
| | Option 4 | (23.9) | (17.6) | <0.1 | (90.8) |
| Ivaco | Baseline: 10-yr Average | 14.0 | 4.3 | 1.2 | 7.0 |
| | Option 4 | 13.9 | 4.3 | 1.2 | 7.0 |
| | Baseline: 1992 | (19.5) | 0.8 | 1.1 | 1.8 |
| | Option 4 | (19.6) | 0.8 | 1.1 | 1.7 |
| Lasco | Baseline: 10-yr Average | 7.9 | 7.2 | 0.7 | 8.8 |
| | Option 1 | 7.8 | 7.2 | 0.7 | 8.7 |
| | Baseline: 1992 | (1.3) | 0.0 | 0.4 | 14.8 |
| | Option 4 | (1.4) | (0.1) | 0.4 | 14.8 |

**Most Recent Year:1992**

The financial performance results when firms' most recent year's performance was adjusted with the postulated BAT Option costs show minor changes compared to the baseline financial performance for that year. With the exception of Algoma, changes to "return on capital" were less that 0.5%. Furthermore, "debt to equity" ratio remained virtually unchanged for all plants. Also, only minor changes to "cash flow to debt" were recorded. Again, it can be concluded that the postulated MISA costs would have only marginal effects on the firms 1992 financial performance.

**Capital Investments**

Relative to the sector firms average 10-year capital investments, the postulated MISA costs are small, ranging between 0.3% and 5.4% of those average annual investments. As shown in **Table A4.5**, the after-tax annualized MISA costs would account for less than 2% of the non-integrated mills average annual capital investments. The potential MISA costs may be proportionally higher for the integrated steel mills than the non-integrated mills. The lowest proportion recorded for all plants is 0.3%, recorded for Ivaco, a non-integrated steel mill.

## Table A4.5
## After-Tax Annualized MISA Costs as A Percentage of Firms' Ten-Year Annual Average Capital Investments

| | Algoma | Dofasco | Stelco | Atlas | Ivaco | Lasco |
|---|---|---|---|---|---|---|
| Ten-Year Average Annual Capital Investment ($'M) | 86.5 | 211.8 | 123.1 | 5.2 | 49.7 | 10.2 |
| After-Tax Annualized MISA Cost ($'M) | 4.7 | 8.1 | 5.6 | 0.09 | 0.14 | 0.17 |
| MISA Cost as a Percentage of Annual Capital Investment (%) | 5.4 | 3.8 | 4.6 | 1.7 | 0.3 | 1.7 |

# Appendix V

## REGULATION MADE UNDER THE ENVIRONMENTAL PROTECTION ACT

## EFFLUENT MONITORING AND EFFLUENT LIMITS -

## IRON AND STEEL MANUFACTURING SECTOR

## ONTARIO REGULATION 214/95

APRIL 1995

ONTARIO REGULATION 214/95; FILED APRIL 13, 1995
ONTARIO GAZETTE - APRIL 29, 1995

# UNOFFICIAL OFFICE COPY VERSION

## REGULATION MADE UNDER THE ENVIRONMENTAL PROTECTION ACT

## EFFLUENT MONITORING AND EFFLUENT LIMITS - IRON AND STEEL MANUFACTURING SECTOR

## PART I
## GENERAL

### INTERPRETATION

**1.** (1) In this Regulation,

"assessment parameter", in relation to a plant, means a parameter that is listed for the plant in Schedule 5;

"cooling water effluent monitoring stream" means a stream on which a sampling point is established under subsection 8 (3);

"cooling water effluent sampling point" means a sampling point established under subsection 8 (3);

"Director", in relation to obligations of a discharger, means a Director appointed under section 5 of the Act and responsible for the region in which the discharger's plant is located and includes an alternate named by the Director;

"discharger" means an owner or person in occupation or having the charge, management or control of a plant to which this Regulation applies;

"limited parameter", in relation to a plant, means a parameter for which a limit is specified in Column 3 or 4 of Schedule 2 for the plant;

"merged effluent monitoring stream" means a stream on which a sampling point is established under subsection 8 (2);

"merged effluent sampling point" means a sampling point established under subsection 8 (2);

"merged parameter", in relation to a plant, means a parameter that is listed for the plant in Schedule 4;

"pick up", in relation to a sample, means pick up for the purpose of storage, including storage within an automatic sampling device, and transportation to and analysis at a laboratory;

"plant" means an industrial facility and the developed property, waste disposal sites and wastewater treatment facilities associated with it;

"process change" means a change in equipment, production processes, process materials or treatment processes;

"process effluent monitoring stream" means a stream on which a sampling point is established under subsection 8 (1);

"process effluent sampling point" means a sampling point established under subsection 8 (1);

"process materials", in relation to a discharger's plant, means raw materials for use in an industrial process at the plant, manufacturing intermediates produced at the plant, or products or by-products of an industrial process at the plant, but does not include chemicals added to cooling water for the purpose of controlling organisms, fouling and corrosion;

"quarter" means all or part of a period of three consecutive months beginning on the first day of January, April, July or October;

"semi-annual period" means all or part of a period of six months beginning on the first day of January or July.

(2) For greater certainty, this Regulation applies both to effluent streams that discharge continuously and to effluent streams that discharge intermittently.

(3) An obligation on a discharger to do a thing under this Regulation is discharged if another person has done it on the discharger's behalf.

### PURPOSE

**2.** The purpose of this Regulation is to monitor and control the quality of effluent discharged from the plants listed in Schedule 1.

### APPLICATION

**3.** (1) This Regulation applies only with respect to the plants listed in Schedule 1.

(2) This Regulation does not apply with respect to the discharge of effluent to a municipal sanitary sewer.

### OBLIGATIONS UNDER APPROVALS, ORDERS, ETC.

**4.** For greater certainty, subject to subsection 186 (4) of the Act, the requirements of this Regulation are in addition to and independent of requirements in an approval, order, direction or other instrument issued under any Act.

### NON-APPLICATION OF THE GENERAL EFFLUENT MONITORING REGULATION

**5.** This Regulation is not a Sectoral Effluent Monitoring Regulation within the meaning of Ontario Regulation 695/88.

### BY-PASSES

**6.** Beginning on April 13, 1998, a discharger shall not permit effluent that would ordinarily flow past a sampling point established under this Regulation to be discharged from the discharger's plant without flowing past that sampling point, regardless of whether it would be convenient to do so because of a maintenance operation, a breakdown in equipment or any scheduled or unscheduled event.

### SAMPLING AND ANALYTICAL PROCEDURES

**7.** (1) Each discharger shall carry out the establishment of sampling point obligations of this Regulation and the sampling and analysis obligations of this Regulation, including quality control sampling and analysis obligations, in accordance with the procedures described in the Ministry of Environment and Energy publication entitled "Protocol for the Sampling and Analysis of Industrial/Municipal Wastewater", dated August, 1994.

(2) Each discharger shall maintain the sampling equipment used at the discharger's plant for sampling required by this Regulation in a way that ensures that the samples collected at the plant under this Regulation accurately reflect the level of discharge of each limited parameter, merged parameter and assessment parameter from the plant.

## PART II
## SAMPLING POINTS

### ESTABLISHMENT AND ELIMINATION OF SAMPLING POINTS

**8.** (1) Each discharger shall, by July 12, 1995, establish a sampling point at each sampling point location designated as a process effluent sampling point in Schedule 2 for the discharger's plant.

(2) Each discharger shall, by July 12, 1995, establish a sampling point at each sampling point location designated as a

merged effluent sampling point in Schedule 4 for the discharger's plant.

(3) Each discharger shall, by July 12, 1995, establish a sampling point at each sampling point location designated as a cooling water effluent sampling point in Schedule 5 for the discharger's plant.

(4) If the Director is satisfied, on the basis of written submissions from a discharger, that one or more of the circumstances described in subsection (5) exist at the discharger's plant, with the result that it is impractical to maintain or use a sampling point established at the plant under this Regulation, the Director may give the discharger written permission to eliminate the sampling point.

(5) For the purposes of subsection (4), the circumstances at the discharger's plant that might make it impractical to maintain or use a sampling point are the following:

1. A process change or redirection of or change in the character of an effluent stream has occurred or is expected to occur at the discharger's plant.

2. Equipment used for sampling or flow measurement at the sampling point is damaged or non-functional.

3. The effluent flowing in the stream on which the sampling point was established under this Regulation has been or is expected to be permanently eliminated.

(6) Where a discharger is permitted to eliminate a sampling point because of a circumstance described in paragraph 1 or 2 of subsection (5), the discharger shall, within 90 days after the day on which the sampling point is eliminated, establish a replacement sampling point.

(7) The replacement sampling point shall be established on the effluent stream from which the sampling point was eliminated, at a location approved in writing by the Director.

(8) The Director shall not approve a location for the replacement sampling point unless he or she is satisfied that monitoring at the new location would yield results that would reflect the level of discharge of each limited parameter, merged parameter and assessment parameter from the discharger's plant as reliably as did monitoring at the eliminated sampling point.

(9) A discharger who replaces a sampling point under subsection (6) has all the same obligations in connection with the replacement sampling point that the discharger had in connection with the eliminated sampling point.

### REPORTS ON SAMPLING POINTS

**9.** (1) By July 24, 1995, each discharger shall submit to the Director a list and plot plan showing the sampling points established under this Regulation at the discharger's plant as of July 12, 1995.

(2) Each discharger who eliminates a sampling point at the discharger's plant under subsection 8 (4) but is not required to replace the sampling point under subsection 8 (6) shall, within 30 days after the day on which a sampling point is eliminated, give the Director a written notice describing where the sampling point used to be, together with a revised list and plot plan without the sampling point.

(3) Within 30 days after replacing a sampling point under subsection 8 (6), the discharger shall give the Director a written notice describing the location of the replacement sampling point, together with a revised list and plot plan showing the replacement sampling point.

### USE OF SAMPLING POINTS ESTABLISHED UNDER THIS PART

**10.** Except as permitted or required under section 24, each discharger shall use the sampling points established under this Part for all sampling required by this Regulation.

## PART III
## CALCULATION OF LOADINGS AND CONCENTRATIONS

### CALCULATION OF LOADINGS - GENERAL

**11.** (1) For the purposes of performing a calculation under sections 12, 13 and 14, a discharger shall use the actual analytical result obtained by the laboratory.

(2) Despite subsection (1), where the actual analytical result is less than one-tenth of the analytical method detection limit set out in the Ministry of Environment and Energy publication entitled "Protocol for the Sampling and Analysis of Industrial/Municipal Wastewater", dated August, 1994, the discharger shall use the value zero for the purpose of performing a calculation under sections 12, 13 and 14.

(3) Each discharger shall ensure that each calculation of a process effluent loading required by section 12 and each calculation of a merged effluent loading required by section 13, is performed as soon as reasonably possible after the analytical result on which the calculation is based becomes available to the discharger.

(4) Each discharger shall ensure that each calculation of a cooling water effluent loading required by section 14 is performed in time to comply with subsection 40 (4).

### CALCULATION OF LOADINGS - PROCESS EFFLUENT

**12.** (1) Each discharger shall calculate, in kilograms, a daily process effluent stream loading for each limited parameter in each process effluent monitoring stream of the discharger for each day on which a sample is collected under this Regulation from the stream for analysis for the parameter.

(2) When calculating a daily stream loading under subsection (1), the discharger shall multiply, with the necessary adjustment of units to yield a result in kilograms, the analytical result obtained from the sample for the parameter by the daily volume of effluent, as determined under section 33, for the stream for the day.

(3) Each discharger shall calculate, in kilograms, a daily process effluent plant loading for each limited parameter for each day for which the discharger is required to calculate a daily process effluent stream loading for the parameter under subsection (1).

(4) For the purposes of subsection (3), a daily process effluent plant loading for a parameter for a day is the sum, in kilograms, of the daily process effluent stream loadings for the parameter calculated under subsection (1) for the day.

(5) Where a discharger calculates only one daily process effluent stream loading for a parameter for a day under subsection (1), the daily process effluent plant loading for the parameter for the day for the purposes of subsection (3) is the single daily process effluent stream loading for the parameter for the day.

(6) Each discharger shall calculate, in kilograms, a monthly average process effluent stream loading for each limited parameter for each month in which a sample is collected under this Regulation more than once from a process effluent monitoring stream at the discharger's plant for analysis for the parameter.

(7) For the purposes of subsection (6), a monthly average process effluent stream loading for a parameter for a month is the arithmetic mean of the daily process effluent stream loadings for the parameter calculated under subsection (1) for the month.

(8) Each discharger shall calculate, in kilograms, a monthly average process effluent plant loading for each limited parameter for each month in which a sample is collected under this Regulation more than once from a process effluent monitoring stream at the discharger's plant for analysis for the parameter.

(9) For the purposes of subsection (8), a monthly average process effluent plant loading for a parameter for a month is the arithmetic mean of the daily process effluent plant loadings for the parameter calculated under subsection (3) for the month.

### CALCULATION OF LOADINGS - MERGED EFFLUENT

**13.** (1) Each discharger shall calculate, in kilograms, a daily merged effluent stream loading for each merged parameter in each merged effluent monitoring stream of the discharger for each day on which a sample is collected under this Regulation from the stream for analysis for the parameter.

(2) When calculating a daily stream loading under subsection (1), the discharger shall multiply, with the necessary adjustment of units to yield a result in kilograms, the analytical result obtained from the sample for the parameter by the daily volume of effluent, as determined under section 33, for the stream for the day.

(3) Each discharger shall calculate, in kilograms, a daily merged effluent plant loading for each merged parameter for each day for which the discharger is required to calculate a merged effluent stream loading for the parameter under subsection (1).

(4) For the purposes of subsection (3), a daily merged effluent plant loading for a parameter for a day is the sum, in kilograms, of the daily merged effluent stream loadings for the parameter calculated under subsection (1) for the day.

(5) Where a discharger calculates only one daily merged effluent stream loading for a parameter for a day under subsection (1), the daily merged effluent plant loading for the parameter for the day for the purposes of subsection (3) is the single daily merged effluent stream loading for the parameter for the day.

(6) Each discharger shall calculate, in kilograms, a monthly average merged effluent stream loading for each merged parameter for each month in which a sample is collected under this Regulation more than once from a merged effluent monitoring stream at the discharger's plant for analysis for the parameter.

(7) For the purposes of subsection (6), a monthly average merged effluent stream loading for a parameter for a month is the arithmetic mean of the daily merged effluent stream loadings for the parameter calculated under subsection (1) for the month.

(8) Each discharger shall calculate, in kilograms, a monthly average merged effluent plant loading for each merged parameter for each month in which a sample is collected under this Regulation more than once from a merged effluent monitoring stream at the discharger's plant for analysis for the parameter.

(9) For the purposes of subsection (8), a monthly average merged effluent plant loading for a parameter for a month is the arithmetic mean of the daily merged effluent plant loadings for the parameter calculated under subsection (3) for the month.

## CALCULATION OF LOADINGS - COOLING WATER

**14.** (1) Each discharger shall calculate, in kilograms, a daily cooling water effluent stream loading for each assessment parameter in each cooling water effluent monitoring stream of the discharger for each day on which a sample is collected under this Regulation from the stream for analysis for the parameter.

(2) When calculating a daily stream loading under subsection (1), the discharger shall multiply, with the necessary adjustment of units to yield a result in kilograms, the analytical result obtained from the sample for the parameter by the daily volume of effluent, as determined under section 33, for the stream for the day.

(3) Each discharger shall calculate, in kilograms, a daily cooling water effluent plant loading for each assessment parameter for each day for which the discharger is required to calculate a daily cooling water effluent stream loading for the parameter under subsection (1).

(4) For the purposes of subsection (3), a daily cooling water effluent plant loading for a parameter for a day is the sum, in kilograms, of the daily cooling water effluent stream loadings for the parameter calculated under subsection (1) for the day.

(5) Where a discharger calculates only one daily cooling water effluent stream loading for a parameter for a day under subsection (1), the daily cooling water effluent plant loading for the parameter for the day for the purposes of subsection (3) is the single daily cooling water effluent stream loading for the parameter for the day.

(6) Each discharger shall calculate, in kilograms, a monthly average cooling water effluent stream loading for each assessment parameter for each month in which a sample is collected under this Regulation more than once from a cooling water effluent monitoring stream at the discharger's plant for analysis for the parameter.

(7) For the purposes of subsection (6), a monthly average cooling water effluent stream loading for a parameter for a month is the arithmetic mean of the daily cooling water effluent stream loadings for the parameter calculated under subsection (1) for the month.

(8) Each discharger shall calculate, in kilograms, a monthly average cooling water effluent plant loading for each assessment

parameter for each month in which a sample is collected under this Regulation more than once from a cooling water effluent monitoring stream at the discharger's plant for analysis for the parameter.

(9) For the purposes of subsection (8), a monthly average cooling water effluent plant loading for a parameter for a month is the arithmetic mean of the daily cooling water effluent plant loadings for the parameter calculated under subsection (3) for the month.

### CALCULATION OF CONCENTRATIONS - PROCESS EFFLUENT - OIL AND GREASE

**15.** (1) Each discharger shall calculate, in milligrams per litre, a monthly average concentration for the parameter oil and grease in each process effluent monitoring stream of the discharger for each month.

(2) For the purposes of subsection (1), a monthly average concentration for the parameter for a month is the arithmetic mean of the analytical results obtained for the parameter from the samples collected under section 20 from the stream for the month.

## PART IV

## PARAMETER AND LETHALITY LIMITS

### PARAMETER LIMITS

**16.** (1) Each discharger shall ensure that each daily process effluent plant loading calculated for a parameter under section 12 in connection with the discharger's plant does not exceed the daily plant loading limit specified for the parameter and the plant in Column 3 of Schedule 2.

(2) Each discharger shall ensure that each monthly average process effluent plant loading calculated for a parameter under section 12 in connection with the discharger's plant does not exceed the monthly average plant loading limit specified for the parameter and the plant in Column 4 of Schedule 2.

(3) Each discharger shall ensure that each monthly average concentration calculated for the parameter oil and grease under section 15 in connection with the discharger's plant does not exceed 15 milligrams per litre.

(4) Subject to subsection (5), each discharger shall control the quality of each process effluent monitoring stream at the discharger's plant to ensure that the pH value of any sample collected at a process effluent sampling point at the plant is within the range of 6.0 to 9.5.

(5) Throughout any day on which a discharger has used an alternate sampling point on a process effluent monitoring stream for sampling required by section 24, as permitted by subsections 24 (7) and (8), the discharger,

(a) shall control the quality of the stream to ensure that the pH value of any sample collected at the alternate sampling point on the stream is within the range of 6.0 to 9.5; and

(b) need not comply with subsection (4) with respect to the stream.

### LETHALITY LIMITS

**17.** Each discharger shall control the quality of each stream at the discharger's plant for which a sampling point is listed in Schedule 6, to ensure that each rainbow trout acute lethality test and each *Daphnia magna* acute lethality test performed on any grab sample collected at a sampling point listed in Schedule 6 for the plant, results in mortality for no more than 50 per cent of the test organisms in 100 per cent effluent.

## PART V
## MONITORING

### MONITORING - GENERAL

**18.** (1) Where a discharger is required by this Regulation to pick up a set of samples and analyze it for certain parameters, the discharger shall pick up a set of samples sufficient to allow all the analyses to be performed.

(2) A discharger shall use all reasonable efforts to ensure that all analyses required by this Regulation are completed as soon as reasonably possible and that the results of those analyses are made available to the discharger as soon as reasonably possible.

(3) Subject to subsection (4), each discharger shall pick up all sets of samples required to be picked up at the discharger's plant under sections 19, 20, 21, 22, 31 and 32 between the hours of 7 a.m. and 10 a.m..

(4) If the Director is satisfied, on the basis of written submissions from a discharger, that the circumstances at the discharger's plant are such that it would be impractical to pick up a set of samples from each sampling point established at the plant under this Regulation within the time period specified in subsection (3), the Director may give the discharger a written notice in respect of the plant, varying the time period specified in subsection (3).

(5) Subject to subsections (6) and (7), where a discharger is required by section 19, 20, 21, 22, 31 or 32 to pick up a set of samples the discharger shall pick up a set collected over the 24-hour period immediately preceding the pick-up.

(6) The 24-hour period referred to in subsection (5) may be shortened or enlarged by up to three hours to permit a discharger to take advantage of the three-hour range specified in subsection (3) or of a different three-hour period specified in a notice under subsection (4).

(7) Where a notice has been given under subsection (4) in respect of a plant specifying a time period longer than three hours, the 24-hour period referred to in subsection (5) may be shortened or enlarged by up to that longer amount of time to permit the discharger to take advantage of the time period specified in the notice.

(8) If the circumstances at a plant change so that the Director is satisfied that the circumstances described in subsection (4) no longer apply at the plant, the Director may revoke a notice given in respect of a plant under subsection (4) by giving a notice of revocation in writing to a discharger for the plant.

### MONITORING - PROCESS EFFLUENT - DAILY

**19.** (1) Each discharger shall, on each day, pick up a set of samples collected at each process effluent sampling point at the discharger's plant and shall, subject to subsection (2), analyze each set of samples for the parameters for which the frequency of monitoring, as set out in Column 2 of Schedule 2 for the discharger's plant, is daily.

(2) A discharger for a plant referred to in Schedule 3 need not analyze any set of samples collected at a process effluent sampling point for any parameter not marked with an "x" in the column for that sampling point in Schedule 3.

(3) A discharger need not meet the requirements of subsection (1) where it is impossible to do so because of sampling by a provincial officer.

### MONITORING - PROCESS EFFLUENT - WEEKLY

**20.** (1) Each discharger shall, on one day in each week, pick up a set of samples collected at each process effluent sampling point at the discharger's plant and shall, subject to subsection (2), analyze each set of samples for the parameters for which the frequency of monitoring, as set out in Column 2 of Schedule 2 for the discharger's plant, is weekly.

(2) A discharger for a plant referred to in Schedule 3 need not analyze any set of samples collected at a process effluent sampling point for any parameter not marked with an "x" in the column for that sampling point in Schedule 3.

(3) There shall be an interval of at least four days between successive pick-up days at the plant under subsection (1).

(4) All samples picked up under subsection (1) in a week shall be picked up on the same day in the week.

### MONITORING - MERGED EFFLUENT - WEEKLY

**21.** (1) Each discharger shall, on one day in each week, pick up a set of samples collected at each merged effluent sampling point at the plant and shall analyze each set of samples for the parameters for which the frequency of monitoring as set out in Column 2 of Schedule 4 for the discharger's plant is weekly.

(2) All samples collected and picked up at a plant under subsection (1) shall be collected and picked up on a day on which samples are picked up at the plant under subsection 20 (1).

### MONITORING - MERGED EFFLUENT - QUARTERLY

**22.** (1) Each discharger shall, on one day in each quarter, on the day on which samples are picked up at the plant under subsection 20 (1), pick up a set of samples collected at each merged effluent sampling point at the discharger's plant and shall, subject to subsection (2), analyze each set of samples for the parameters for which the frequency of monitoring, as set out in Column 2 of Schedule 4 for the discharger's plant, is quarterly.

(2) There shall be an interval of at least 45 days between successive pick-up days at the plant under subsection (1).

(3) All samples picked up under subsection (1) in a quarter shall be picked up on the same day in the quarter.

### MONITORING - PROCESS EFFLUENT - QUALITY CONTROL

**23.** (1) On one day in each year after 1995, on a day on which samples are picked up at the plant under subsection 20 (1), each discharger shall collect and pick up a duplicate sample for each sample picked up on that day under subsection 20 (1) at one process effluent sampling point at the discharger's plant and shall analyze each duplicate sample for the parameters for which the frequency of monitoring, as set out in Column 2 of Schedule 2 for the discharger's plant, is weekly.

(2) Each discharger shall prepare a travelling blank and a travelling spiked blank sample for each sample for which a

duplicate sample is picked up at the plant under subsection (1) and shall analyze the travelling blank and travelling spiked blank samples in accordance with the directions set out in the Ministry of Environment and Energy publication entitled "Protocol for the Sampling and Analysis of Industrial/Municipal Wastewater", dated August, 1994.

(3) There shall be an interval of at least six months between successive pick-up days at the plant under subsection (1).

### MONITORING - PROCESS EFFLUENT - pH MEASUREMENT

**24.** (1) Each discharger shall, on each day, during the time period applicable to the plant under subsection 18 (3) or (4), collect a grab sample from each process effluent sampling point at the discharger's plant and shall analyze each sample for the parameter pH.

(2) Each discharger shall, within each 24-hour period beginning with the collection of the first grab sample at the plant under subsection (1) on each day, collect two more grab samples from each process effluent sampling point at the discharger's plant and shall analyze each sample for the parameter pH.

(3) There shall be an interval of at least four hours between each of the three collections at a sampling point under subsections (1) and (2) in each 24-hour period.

(4) Each grab sample collected under subsections (1) and (2) shall be picked up within 24 hours of when it was collected.

(5) Instead of complying with subsections (1) to (4) with respect to a sampling point, a discharger may use an on-line analyzer at the sampling point on the stream and analyze the effluent at the sampling point for the parameter pH once in each day during the time period applicable to the plant under subsection 18 (3) or (4), and two more times in each 24-hour period beginning with the first analysis at the plant under this subsection in each day.

(6) There shall be an interval of at least four hours between each of the three analyses at a sampling point under subsection (5) in each 24-hour period.

(7) For the purposes of subsections (1) to (6), a discharger shall use either the sampling point established under subsection 8 (1) on the stream or an alternate sampling point located downstream of the sampling point but before the point of discharge of the stream to surface water or to an industrial sewer used in common with another plant.

(8) Before using an alternate sampling point under subsection (7), a discharger shall give the Director,

(a) a written notice that,

(i) sets out the name of the alternate sampling point,

(ii) describes its location, and

(iii) assigns a number to it; and

(b) a revised version of the list and plot plan submitted under section 9 showing the alternate sampling point.

### MONITORING - ACUTE LETHALITY TESTING - RAINBOW TROUT

**25.** (1) Where a discharger is required by this section to perform a rainbow trout acute lethality test, the discharger shall perform the test according to the procedures described in the Environment Canada publication entitled "Biological Test Method: Reference Method for Determining Acute Lethality of Effluents to Rainbow Trout", dated July, 1990.

(2) Each rainbow trout acute lethality test required by this section shall be carried out as a single concentration test using 100 per cent effluent.

(3) On one day in each month, each discharger shall collect and immediately pick up a grab sample at each process effluent sampling point listed in Schedule 6 for the discharger's plant and shall perform a rainbow trout acute lethality test on each sample.

(4) All samples collected and picked up at a plant under subsection (3) shall be collected and picked up on a day on which samples are picked up at the plant under subsection 20 (1).

(5) There shall be an interval of at least 15 days between successive pick-up days at the plant under subsection (3).

(6) All samples picked up under subsection (3) in a month shall be picked up on the same day in the month.

(7) Where a discharger has performed tests under subsection (3) for 12 consecutive months on samples collected from the same sampling point and the mortality of the rainbow trout in each test did not exceed 50 per cent, the discharger is relieved of the obligations under subsection (3) relating to the sampling point and shall instead collect and immediately pick up a grab sample at the sampling point on one day in each quarter and perform a rainbow trout acute lethality test on each sample.

(8) Samples picked up at a plant under subsection (7) shall be picked up on a day on which samples are picked up at the plant under subsection (3).

(9) If no samples are being picked up at a plant under subsection (3) during a quarter, samples picked up at the plant during the quarter under subsection (7) shall be picked up on a day on which samples are picked up at the plant under subsection 20 (1).

(10) There shall be an interval of at least 45 days between successive pick-up days at the plant under subsection (7).

(11) All samples picked up under subsection (7) in a quarter shall be picked up on the same day in the quarter.

(12) If a rainbow trout acute lethality test performed under subsection (7) on any sample from a sampling point results in mortality of more than 50 per cent of the test rainbow trout, subsections (7) to (11) cease to apply in relation to samples from that sampling point, and a discharger shall instead comply with the requirements of subsection (3) relating to the sampling point, until the tests performed under subsection (3) on all samples collected from the sampling point for a further 12 consecutive months result in mortality for no more than 50 per cent of the rainbow trout for each test.

(13) A discharger shall notify the Director in writing of any change in the frequency of acute lethality testing under this Regulation at the discharger's plant, within 30 days after the day on which the change begins.

(14) A discharger may notify the Director in writing of any period in which the testing of samples collected at a sampling point under subsection (3) would always result in mortality of more than 50 per cent of the test rainbow trout.

(15) Where a notice is given under subsection (14), a discharger is relieved of the obligations under subsection (3) relating to the sampling point during the period in which the testing of samples collected at the sampling point would always result in mortality of more than 50 per cent of the test rainbow trout.

(16) Subsections (14) and (15) are revoked on April 13, 1998.

(17) Subsections (2) to (16) apply with necessary modifications to each merged effluent sampling point listed in Schedule 6 for the discharger's plant and, for the purpose, the reference in subsection (3) to each process effluent sampling point listed in Schedule 6 shall be deemed to be a reference to each merged effluent sampling point listed in Schedule 6 and the reference in

subsections (4) and (9) to subsection 20 (1) shall be deemed to be a reference to subsection 21 (1).

(18) Subsections (2) to (16) apply with necessary modifications to each cooling water effluent sampling point listed in Schedule 6 for the discharger's plant and, for the purpose, the reference in subsection (3) to each process effluent sampling point listed in Schedule 6 shall be deemed to be a reference to each cooling water effluent sampling point listed in Schedule 6 and the reference in subsections (4) and (9) to subsection 20 (1) shall be deemed to be a reference to subsection 31 (1).

### MONITORING - ACUTE LETHALITY TESTING - *DAPHNIA MAGNA*

**26.** (1) Where a discharger is required by this section to perform a *Daphnia magna* acute lethality test, the discharger shall perform the test according to the procedures described in the Environment Canada publication entitled "Biological Test Method: Reference Method for Determining Acute Lethality of Effluents to *Daphnia magna*", dated July, 1990.

(2) Subsections 25 (2) to (18) apply with necessary modifications to *Daphnia magna* acute lethality tests and, for the purpose, a reference to rainbow trout shall be deemed to be a reference to *Daphnia magna*.

(3) Each discharger shall pick up each set of samples required to be collected from a sampling point at the discharger's plant under this section on a day on which the discharger collects a sample from the sampling point under section 25, to the extent possible having regard to the frequency of monitoring required at the sampling point under this section and section 25.

### MONITORING - ACUTE LETHALITY TESTING - RAINBOW TROUT - SAMPLING POINTS LISTED IN SCHEDULE 7

**27.** (1) Beginning on April 13, 1998, on one day in each month, on a day on which samples are picked up at the plant under section 20, each discharger shall collect and immediately pick up a grab sample at each sampling point that is listed in Schedule 7 for the discharger's plant and shall perform a rainbow trout acute lethality test on each sample.

(2) Subsections 25 (1) and (2) apply with necessary modifications to each sample picked up at the discharger's plant under subsection (1).

(3) There shall be an interval of at least 15 days between successive pick-up days at the plant under subsection (1).

(4) All samples picked up under subsection (1) in a month shall be picked up on the same day in the month.

(5) Where a discharger has performed tests under subsection (1) for 12 consecutive months on samples collected from the same sampling point, the discharger is relieved of the obligations under subsection (1) relating to the sampling point and shall instead collect and immediately pick up a grab sample at the sampling point on one day in each quarter and perform a rainbow trout acute lethality test on each sample.

(6) Samples picked up at a plant under subsection (5) shall be picked up on a day on which samples are picked up at the plant under subsection (1).

(7) If no samples are being picked up at a plant under subsection (1) during a quarter, samples picked up at the plant during the quarter under subsection (5) shall be picked up on a day on which samples are picked up at the plant under section 20.

(8) There shall be an interval of at least 45 days between successive pick-up days at the plant under subsection (5).

(9) All samples picked up under subsection (5) in a quarter shall be picked up on the same day in the quarter.

### MONITORING - ACUTE LETHALITY - *DAPHNIA MAGNA*
### SAMPLING POINTS LISTED IN SCHEDULE 7

**28.** (1) Where a discharger is required by this section to perform a *Daphnia magna* acute lethality test, the discharger shall perform the test according to the procedures described in the Environment Canada publication entitled "Biological Test Method: Reference Method for Determining Acute Lethality of Effluents to *Daphnia magna*", dated July, 1990.

(2) Each *Daphnia magna* acute lethality test required by this section shall be carried out as a single concentration test using 100 per cent effluent.

(3) Beginning on April 13, 1998, on one day in each month, on a day on which samples are picked up at the plant under section 20, each discharger shall collect and immediately pick up a grab sample at each sampling point that is listed in Schedule 7 for the discharger's plant and shall perform a *Daphnia magna* acute lethality test on each sample.

(4) There shall be an interval of at least 15 days between successive pick-up days at the plant under subsection (3).

(5) All samples picked up under subsection (3) in a month shall be picked up on the same day in the month.

(6) Where a discharger has performed tests under subsection (3) for 12 consecutive months on samples collected from the same sampling point, the discharger is relieved of the obligations under subsection (3) relating to the sampling point and shall instead collect and immediately pick up a grab sample at the sampling point on one day in each quarter and perform a *Daphnia magna* acute lethality test on each sample.

(7) Samples picked up at a plant under subsection (6) shall be picked up on a day on which samples are picked up at the plant under subsection (3).

(8) If no samples are being picked up at a plant under subsection (3) during a quarter, samples picked up at the plant during the quarter under subsection (6) shall be picked up on a day on which samples are picked up at the plant under section 20.

(9) There shall be an interval of at least 45 days between successive pick-up days at the plant under subsection (6).

(10) All samples picked up under subsection (6) in a quarter shall be picked up on the same day in the quarter.

### MONITORING - ACUTE LETHALITY - TOXICITY ELIMINATION REPORTS

**29.** (1) If three consecutive rainbow trout acute lethality tests performed under subsection 27 (1) or (5) or under a combination of subsections 27 (1) and (5) on samples picked up at a sampling point result in the mortality of more than 50 per cent of the test rainbow trout, the discharger shall submit to the Director a toxicity elimination report with respect to the stream on which the sampling point is located.

(2) A toxicity elimination report with respect to the stream on which the sampling point is located shall set out the following information:

1. A detailed analysis of the causes and sources of the mortality of more than 50 per cent of the test rainbow trout at the sampling point.
2. A synopsis of any studies conducted to support the analysis.
3. A detailed description of the methods by which the quality of the stream could be controlled to eliminate the mortality of more than 50 per cent of the test rainbow trout at the sampling point.
4. An evaluation of the technical feasibility of implementing, at the discharger's plant, each method

described under paragraph 3 and a statement of which of the methods are technically feasible.

5. An estimate of the financial cost to the discharger of implementing each method identified as technically feasible under paragraph 3.

(3) Where a discharger is required by subsection (1) to submit a toxicity elimination report to the Director, the discharger shall submit the report to the Director no later than 12 months after the day on which the third of three consecutive rainbow trout acute lethality tests was performed that resulted in the mortality of more than 50 per cent of the test rainbow trout at the sampling point on the stream.

(4) In addition, where a discharger is required by subsection (1) to submit a toxicity elimination report with respect to a stream, the discharger shall submit to the Director annual toxicity elimination progress reports with respect to the stream, no later than the anniversary of the day on which the toxicity elimination report with respect to the stream was required to be submitted under subsection (3).

(5) A toxicity elimination progress report with respect to a stream shall set out the following information:

1. A detailed description of any methods, in addition to those described under paragraph 3 of subsection (2) with respect to the stream, by which the quality of the stream could be controlled to eliminate the mortality of more than 50 per cent of the test rainbow trout at the sampling point.

2. An evaluation of the technical feasibility of implementing, at the discharger's plant, each method described under paragraph 1 and a statement of which of the methods are technically feasible.

3. An estimate of the financial cost to the discharger of implementing each method identified as technically feasible under paragraph 2.

(6) Where a discharger has performed three consecutive quarterly tests under subsection 27 (5) on samples collected from a stream in relation to which the discharger has obligations under subsection (4) and the mortality of the rainbow trout in each test did not exceed 50 per cent, the discharger is relieved of the obligations under subsection (4) in relation to that stream.

(7) Where a discharger has been relieved by subsection (6) of the obligation to submit toxicity elimination progress reports in relation to a stream and three consecutive quarterly tests under

subsection 27 (5) on samples collected from that stream result in the mortality of more than 50 per cent of the test rainbow trout, subsection (6) ceases to apply and the discharger shall instead comply with the requirements of subsection (4) relating to the stream, until a further three consecutive quarterly tests under subsection 27 (5) on samples collected from the stream result in mortality for no more than 50 per cent of the rainbow trout in each test.

(8) Subsections (1) to (7) apply with necessary modifications to *Daphnia magna* acute lethality tests performed under section 28 and, for the purpose,

(a) a reference to rainbow trout shall be deemed to be a reference to *Daphnia magna*; and

(b) a reference to subsection 27 (1) shall be deemed to be a reference to subsection 28 (3) and a reference to subsection 27 (5) shall be deemed to be a reference to subsection 28 (6).

### MONITORING - CHRONIC TOXICITY TESTING - FATHEAD MINNOW AND *CERIODAPHNIA DUBIA*

**30.** (1) Where a discharger is required to perform a seven-day fathead minnow growth inhibition test, the discharger shall perform the test according to the procedure described in the Environment Canada publication entitled "Biological Test Method: Test of Larval Growth and Survival Using Fathead Minnows" dated February, 1992.

(2) Where a discharger is required to perform a seven-day *Ceriodaphnia dubia* reproduction inhibition and survivability test, the discharger shall perform the test according to the procedure described in the Environment Canada publication entitled "Biological Test Method: Test of Reproduction and Survival Using the Cladoceran *Ceriodaphnia dubia*", dated February, 1992.

(3) On one day in each semi-annual period, on the day on which samples are picked up at the plant under section 20, each discharger shall collect and immediately pick up a grab sample from each sampling point listed in Schedule 8 for the discharger's plant, and shall perform a seven-day fathead minnow growth inhibition test and a seven-day *Ceriodaphnia dubia* reproduction inhibition and survivability test on each sample.

(4) There shall be an interval of at least 90 days between successive pick-up days at the plant under subsection (3).

(5) All samples picked up under subsection (3) in a semi-annual period shall be picked up on the same day in the semi-annual period.

(6) A discharger need not collect a sample from a sampling point in accordance with subsection (3) until 12 consecutive monthly rainbow trout acute lethality tests and 12 consecutive monthly *Daphnia magna* acute lethality tests performed on samples collected at the sampling point at a discharger's plant result in mortality for no more than 50 per cent of the test organisms in 100 per cent effluent.

### MONITORING - COOLING WATER EFFLUENT - WEEKLY ASSESSMENT

**31.** (1) Each discharger shall, on one day in each week, on a day on which samples are picked up at the plant under subsection 20 (1), pick up a set of samples collected at each cooling water effluent sampling point at the discharger's plant and shall, subject to subsection (2), analyze each set of samples for the parameters for which the frequency of monitoring, as set out in Column 2 of Schedule 5 for the discharger's plant, is weekly.

(2) A discharger for a plant referred to in Schedule 5 need not analyze any set of samples collected at a cooling water effluent sampling point for any parameter not marked with an "x" in the column for that sampling point in Schedule 5.

(3) There shall be an interval of at least four days between successive pick-up days at the plant under subsection (1).

(4) All samples picked up under subsection (1) in a week shall be picked up on the same day in the week.

### MONITORING - COOLING WATER EFFLUENT - QUARTERLY

**32.** (1) Each discharger shall, on one day in each quarter, on a day on which samples are picked up at the plant under subsection 20 (1), pick up a set of samples collected at each cooling water effluent sampling point at the discharger's plant and shall, subject to subsection (2), analyze each set of samples for the parameters for which the frequency of monitoring, as set out in Column 2 of Schedule 5 for the discharger's plant, is quarterly.

(2) A discharger for a plant referred to in Schedule 5 need not analyze any set of samples collected at a cooling water effluent sampling point for any parameter not marked with an "x" in the column for that sampling point in Schedule 5.

(3) There shall be an interval of at least 45 days between successive pick-up days at the plant under subsection (1).

(4) All samples picked up under subsection (1) in a quarter shall be picked up on the same day in the quarter.

## PART VI
## EFFLUENT VOLUME

### FLOW MEASUREMENT

**33.** (1) For the purposes of this section, a volume of effluent for a stream for a day is the volume that flowed past the sampling point established under section 8 on the stream during the 24-hour period preceding the pick-up of the first sample picked up from the stream for the day.

(2) Each discharger shall determine in cubic metres a daily volume of effluent for each process effluent monitoring stream at the discharger's plant for each day on which a sample is collected under this Regulation from the stream, by integration of continuous flowrate measurements.

(3) Despite subsection (2), where a process effluent monitoring stream discharges on an intermittent basis, the daily volumes for the stream may be determined either by integration of continuous flowrate measurements or by the summation of the individual intermittent volume measurements.

(4) Each discharger shall use flow measurement methods that allow the daily volumes for process effluent monitoring streams to be determined to an accuracy of within plus or minus 15 per cent.

(5) Each discharger shall determine in cubic metres a daily volume of effluent for each merged effluent monitoring stream at the discharger's plant for each day on which a sample is collected under this Regulation from the stream.

(6) Each discharger shall use flow measurement methods that allow the daily volumes for merged effluent monitoring streams to be determined to an accuracy of within plus or minus 20 per cent.

(7) Each discharger shall determine in cubic metres a daily volume of effluent for each cooling water effluent monitoring stream at the discharger's plant for each day on which a sample is collected under this Regulation from the stream.

(8) Each discharger shall use flow measurement methods that allow the daily volumes for cooling water effluent monitoring streams to be determined to an accuracy of within plus or minus 20 per cent.

(9) Each discharger shall, no later than the day that this section comes into force, determine by calibration or confirm by means of a certified report of a registered professional engineer of the Province of Ontario that,

(a) each flow measurement method used under subsections (2) and (3) meets the accuracy requirements of subsection (4);

(b) each flow measurement method used under subsection (5) meets the accuracy requirements of subsection (6); and

(c) each flow measurement method used under subsection (7) meets the accuracy requirements of subsection (8).

(10) Where a discharger uses a new flow measurement method or alters an existing flow measurement method, the discharger shall determine by calibration or confirm by means of a certified report of a registered professional engineer of the Province of Ontario that each new or altered flow measurement method meets the accuracy requirements of subsection (4), (6) or (8), as the case may be, within two weeks after the day on which the new or altered method or system is used.

(11) Each discharger shall develop and implement a maintenance schedule and a calibration schedule for each flow measurement system installed at the discharger's plant and shall maintain each flow measurement system according to good operating practices.

(12) Each discharger shall use reasonable efforts to set up each flow measurement system used for the purposes of this section in a way that permits inspection by a provincial officer.

### CALCULATION OF STREAM AND PLANT VOLUMES

**34.** (1) Each discharger shall calculate, in cubic metres, a daily process effluent plant volume for each day.

(2) For the purposes of subsection (1), a process effluent plant volume for a day is the sum of the daily process effluent volumes determined under section 33 for the day.

(3) Each discharger shall calculate, in cubic metres, a monthly average process effluent plant volume for each month, by taking the arithmetic mean of the daily process effluent plant volumes calculated under subsection (1) for the month.

(4) Each discharger shall calculate, in cubic metres, a monthly average volume for each process effluent monitoring stream at the discharger's plant for each month, by taking the arithmetic mean of the daily volumes determined under section 33 for the stream for the month.

(5) Each discharger shall calculate, in cubic metres, a daily merged effluent plant volume for each day.

(6) For the purposes of subsection (5), a merged effluent plant volume for a day is the sum of the daily merged effluent volumes determined under section 33 for the day.

(7) Each discharger shall calculate, in cubic metres, a monthly average merged effluent plant volume for each month, by taking the arithmetic mean of the daily merged effluent plant volumes calculated under subsection (5) for the month.

(8) Each discharger shall calculate, in cubic metres, a monthly average volume for each merged effluent monitoring stream at the discharger's plant for each month, by taking the arithmetic mean of the daily volumes determined under section 33 for the stream for the month.

(9) Each discharger shall calculate, in cubic metres, a daily cooling water effluent plant volume for each day.

(10) For the purposes of subsection (9), a cooling water effluent plant volume for a day is the sum of the daily cooling water volumes determined under section 33 for the day.

(11) Each discharger shall calculate, in cubic metres, a monthly average cooling water effluent plant volume for each month, by taking the arithmetic mean of the daily cooling water effluent plant volumes calculated under subsection (9) for the month.

(12) Each discharger shall calculate, in cubic metres, a monthly average volume for each cooling water effluent monitoring stream at the discharger's plant for each month, by taking the arithmetic mean of the daily volumes for the stream determined under section 33 for the month.

## PART VII
## STORM WATER CONTROL

### STORM WATER CONTROL STUDY

**35.** (1) Each discharger shall complete a storm water control study in respect of the discharger's plant, in accordance with the requirements of the Ministry of Environment and Energy publication entitled "Protocol for Conducting a Storm Water Control Study", dated August, 1994.

(2) A discharger need not comply with subsection (1) in respect of the discharger's plant if,

(a) the plant meets the exemption criteria set out in the Ministry of Environment and Energy publication entitled "Protocol for Conducting a Storm Water Control Study", dated August, 1994; and

(b) the discharger notifies the Director in writing, by April 12, 1996, that the plant meets the exemption criteria referred to in clause (a).

(3) Subject to subsection (4), a discharger shall complete the storm water control study in respect of the discharger's plant by April 14, 1997.

(4) A discharger may postpone completion of the storm water control study in respect of the discharger's plant until April 12, 1999 if,

(a) in order to meet the requirements of Part IV, the discharger plans to make process changes, install wastewater treatment facilities, implement management practices, or make any other changes at the plant that would likely alter the quantity or quality of storm water discharged from the plant; and

(b) the discharger notifies the Director in writing, by April 14, 1997, of the plans referred to in clause (a).

(5) Each discharger shall ensure that a copy of each study completed under this section is available to Ministry staff at the discharger's plant, on request during the plant's normal office hours.

## PART VIII
## RECORDS AND REPORTS

### RECORD KEEPING

**36.** (1) Each discharger shall keep records, in an electronic format acceptable to the Director, of all analytical results obtained under sections 19 to 22, 24, 31 and 32, all calculations performed under sections 12 to 15, and all determinations and calculations made or performed under sections 33 and 34.

(2) Each discharger shall keep records of all sampling and analytical procedures used in meeting the requirements of section 7, including, for each sample, the date, the time of pick-up, the sampling procedures used and any incidents likely to affect the analytical results.

(3) Each discharger shall keep records of the results of all monitoring performed under sections 23, 25, 26 and 30.

(4) Each discharger shall keep records of all maintenance and calibration procedures performed under section 33.

(5) Each discharger shall keep records of all problems or malfunctions, including those related to sampling, analysis, acute

lethality testing, chronic toxicity testing or flow measurement, that result or are likely to result in a failure to comply with a requirement of this Regulation, stating the date, duration and cause of each malfunction, and including a description of any remedial action taken.

(6) Each discharger shall keep records of any incident in which effluent that would ordinarily flow past a sampling point established under this Regulation is discharged from the discharger's plant without flowing past that sampling point, stating the date, duration, cause and nature of each incident.

(7) Each discharger shall keep records of all process changes and redirections of or changes in the character of effluent streams that affect the quality of effluent at any sampling point established under this Regulation at the discharger's plant.

(8) Each discharger shall keep records of the daily production, in tonnes, for the products listed in Column 2 of Schedule 9 for the discharger's plant.

(9) Each discharger shall make each record required by this section as soon as reasonably possible and shall keep each such record for a period of three years.

(10) Each discharger shall ensure that all records kept under this section are available to Ministry staff at the discharger's plant, on request during the plant's normal office hours.

## Reports Available to the Public

**37.** (1) On or before June 1 in each year, each discharger shall prepare a report relating to the previous calendar year and including,

(a) a summary of plant loadings calculated under sections 12 to 14;

(b) a summary of concentrations determined under section 15;

(c) a summary of the results of monitoring performed under sections 19 to 22, 24 to 26 and 30 to 32;

(d) a summary of calculations performed under subsections 34 (1), (5) and (9);

(e) a summary of the loadings or other results that exceeded a limit under section 16 or 17; and

(f) a summary of the incidents in which effluent that would ordinarily flow past a sampling point established under this Regulation is discharged from the discharger's plant without flowing past that sampling point.

(2) Each discharger shall ensure that each report prepared under subsection (1) is available to any person at the discharger's plant, on request during the plant's normal office hours.

(3) Each discharger shall provide the Director, upon request, with a copy of any report that the discharger has prepared under subsection (1).

(4) Each discharger shall ensure that each report prepared under section 30 is available to any person at the discharger's plant, on request during the plant's normal office hours.

### REPORTS TO THE DIRECTOR - GENERAL

**38.** (1) Each discharger shall notify the Director in writing of any change of name or ownership of the discharger's plant occurring after April 13, 1995, within 30 days after the end of the month in which the change occurs.

(2) Each discharger shall notify the Director in writing of any process change or redirection of or change in the character of an effluent stream that affects the quality of effluent at any sampling point established under this Regulation at the discharger's plant, within 30 days of the change or redirection.

(3) A discharger need not comply with subsection (2) where the effect of the change or redirection on effluent quality is of less than one week's duration.

(4) Each discharger shall notify the Director in writing if the discharger's plant has, for 90 consecutive days, operated at less than 75 per cent of the production rate specified in Column 3 of Schedule 9 for the discharger's plant, within 30 days of the end of the 90-day period.

### REPORTS TO THE DIRECTOR - COMPLIANCE WITH SECTION 6 AND PART IV

**39.** (1) Each discharger shall report to the Director any incident in which effluent that would ordinarily flow past a sampling point established under this Regulation is discharged from the discharger's plant without flowing past that sampling point.

(2) Each discharger shall report to the Director any loading or other result that exceeds a limit prescribed by section 16 or 17.

(3) A report required under subsection (1) or (2) shall be given orally, as soon as reasonably possible, and in writing, as soon as reasonably possible.

### QUARTERLY REPORTS TO THE DIRECTOR

**40.** (1) No later than 45 days after the end of each quarter, each discharger shall submit a report to the Director containing information relating to the discharger's plant throughout the quarter as required by subsections (3) to (8).

(2) A report under this section shall be submitted both in an electronic format acceptable to the Director and in hard copy generated from the electronic format and signed by the discharger.

(3) A report under this section shall include all information included in a report given under section 39 during the quarter.

(4) Each discharger shall report, for each month in the quarter,

(a) the monthly average stream loadings for each stream and the highest and lowest daily stream loadings for each stream calculated under section 12 for each limited parameter;

(b) the monthly average plant loadings and the highest and lowest daily plant loadings calculated under section 12 for each limited parameter;

(c) the monthly average stream loadings for each stream and the highest and lowest daily stream loadings for each stream calculated under section 13 for each merged parameter;

(d) the monthly average plant loadings and the highest and lowest daily plant loadings calculated under section 13 for each merged parameter;

(e) the monthly average stream loadings for each stream and the highest and lowest daily stream loadings for each stream calculated under section 14 for each assessment parameter;

(f) the monthly average plant loadings and the highest and lowest daily plant loadings calculated under section 14 for each assessment parameter.

(5) Each discharger shall report, for each month in the quarter,

(a) the monthly average stream volumes for each stream and the highest and lowest daily stream volumes for each stream calculated under sections 33 and 34;

(b) the monthly average process effluent plant volume and the highest and lowest daily process effluent plant volumes calculated under section 34;

(c) the monthly average merged effluent plant volume and the highest and lowest daily merged effluent plant volumes calculated under section 34; and

(d) the monthly average cooling water effluent plant volume and the highest and lowest daily cooling water effluent plant volumes calculated under section 34.

(6) Each discharger shall, for each sampling point established under this Regulation at the discharger's plant, report the number of days in each month in the quarter on which effluent flowed past the sampling point.

(7) Each discharger shall report, for each month in the quarter, the highest and lowest pH results obtained under section 24 for each process effluent monitoring stream at the discharger's plant.

### REPORTS TO THE DIRECTOR - CHRONIC TOXICITY TESTING

**41.** (1) Each discharger shall report to the Director the results of all monitoring performed under section 30, together with the date on which each sample was picked up, no later than 60 days after the end of each semi-annual period in which the monitoring was performed.

(2) A report under subsection (1) shall include a plot of percentage reduction in growth or reproduction against the logarithm of test concentration and shall include a calculation of the concentration at which a 25 per cent reduction in growth or reproduction would occur.

## PART IX
## COMMENCEMENT AND REVOCATION PROVISIONS

### REVOCATION OF O.REG. 321/89

42. Ontario Regulations 321/89, 602/89 and 139/90 are revoked on July 12, 1995.

### COMMENCEMENT OF PARTS IV, V AND VI

43. (1) Part IV comes into force on April 13, 1998.

(2) Parts V and VI come into force on July 12, 1995.

## Schedule 1
## List of Regulated Plants

| Plant Name | Location | Owner as of March 1, 1995 |
|---|---|---|
| Algoma Steel | Sault Ste. Marie | Algoma Steel Inc. |
| Atlas Specialty Steels | Welland | Sammi Atlas Inc. |
| Dofasco | Hamilton | Dofasco Inc. |
| Ivaco Rolling Mills Limited Partnership | L'Orignal | Ivaco Inc. and Ivaco Rolling Mills Inc. |
| Lake Ontario Steel Company (LASCO) | Whitby | Co-Steel International Ltd. |
| Stelco Hilton Works | Hamilton | Stelco Inc. |
| Stelco Lake Erie Works | Nanticoke | Stelco Inc. |

## Schedule 2
## Process Effluent: Designated Sampling Points, Limits, Monitoring Frequency

### Schedule 2
### PLANT: Algoma Steel (Sault Ste. Marie)

**Designated Process Effluent Sampling Points:**
0100, Bar & Strip Lagoon Effluent
0400, #1 Tube Mill Effluent
0700, Main Filter Plant Effluent
1800, #2 Tube Mill Effluent

| ATG | Parameter | Monitoring Frequency | Daily Plant Loading Limit kg/day | Monthly Average Plant Loading Limit kg/day |
|---|---|---|---|---|
| | Column 1 | Column 2 | Column 3 | Column 4 |
| 2 | Total Cyanide | W | 35.4 | 16.4 |
| 4a | Ammonia plus Ammonium | W | 608 | 219 |
| 8 | Total Suspended Solids (TSS) | D | 6,520 | 2,380 |
| 9 | Total Lead | W | 24.5 | 11.3 |
| | Total Zinc | W | 51.1 | 22.5 |
| 14 | Phenolics (4AAP) | W | 4.34 | 1.45 |
| 17 | Benzene | W | 0.417 | 0.143 |
| 19 | Benzo(a)pyrene | W | 0.481 | 0.166 |
| | Naphthalene | W | 1.12 | 0.389 |
| 25 | Oil and Grease | W | | |

Explanatory notes:

| | |
|---|---|
| ATG | Analytical Test Group |
| kg/day | kilograms per day |
| D | Daily monitoring requirement |
| W | Weekly monitoring requirement |

## Schedule 2
## PLANT: Atlas Specialty Steels (Welland)

**Designated Process Effluent Sampling Point:**
0300, North Treatment Plant Effluent

| ATG | Parameter | Monitoring Frequency | Daily Plant Loading Limit kg/day | Monthly Average Plant Loading Limit kg/day |
|---|---|---|---|---|
| | Column 1 | Column 2 | Column 3 | Column 4 |
| 8 | Total Suspended Solids (TSS) | D | 95.8 | 30.6 |
| 9 | Total Nickel | D | 4.99 | 1.58 |
| | Total Zinc | D | 3.68 | 0.751 |
| | Total Chromium | D | 0.801 | 0.227 |
| 25 | Oil and Grease | W | | |

Explanatory notes:

| | |
|---|---|
| ATG | Analytical Test Group |
| kg/day | kilograms per day |
| D | Daily monitoring requirement |
| W | Weekly monitoring requirement |

## Schedule 2
## PLANT: Dofasco (Hamilton)

**Designated Process Effluent Sampling Points:**
0700, Coke Plant Effluent
0800, Blast Furnace Recycle Blowdown
0900, Steelmaking Effluent
1101, #1 Acid Regeneration Filter Discharge
2000, #2 Hot Mill Filter Plant Effluent

| ATG | Parameter | Monitoring Frequency | Daily Plant Loading Limit kg/day | Monthly Average Plant Loading Limit kg/day |
|---|---|---|---|---|
| | Column 1 | Column 2 | Column 3 | Column 4 |
| 2 | Total Cyanide | W | 44.1 | 19.8 |
| 4a | Ammonia plus Ammonium | W | 344 | 152 |
| 8 | Total Suspended Solids (TSS) | D | 1,760 | 646 |
| 9 | Total Lead | W | 21.2 | 6.08 |
| | Total Zinc | W | 36.1 | 11.7 |
| 14 | Phenolics (4AAP) | W | 1.08 | 0.364 |
| 17 | Benzene | W | 0.136 | 0.0452 |
| 19 | Benzo(a)pyrene | W | 0.136 | 0.0452 |
| | Naphthalene | W | 0.136 | 0.0452 |
| 25 | Oil and Grease | W | | |

Explanatory notes:

| | |
|---|---|
| ATG | Analytical Test Group |
| kg/day | kilograms per day |
| D | Daily monitoring requirement |
| W | Weekly monitoring requirement |

## Schedule 2
## PLANT: Ivaco Rolling Mills Limited Partnership (L'Orignal)

**Designated Process Effluent Sampling Point:**
0900, Rod Mill Filter Effluent

| ATG | Parameter | Monitoring Frequency | Daily Plant Loading Limit | Monthly Average Plant Loading Limit |
|---|---|---|---|---|
| | | | kg/day | kg/day |
| | Column 1 | Column 2 | Column 3 | Column 4 |
| 8 | Total Suspended Solids (TSS) | D | 74.0 | 27.7 |
| 9 | Total Lead | D | 0.508 | 0.146 |
| | Total Zinc | D | 0.628 | 0.219 |
| 25 | Oil and Grease | W | | |

Explanatory notes:

| | |
|---|---|
| ATG | Analytical Test Group |
| kg/day | kilograms per day |
| D | Daily monitoring requirement |
| W | Weekly monitoring requirement |

## Schedule 2
## PLANT: Lake Ontario Steel Company (LASCO) (Whitby)

**Designated Process Effluent Sampling Point:**
0100, South Pond Effluent

| ATG | Parameter | Monitoring Frequency | Daily Plant Loading Limit kg/day | Monthly Average Plant Loading Limit kg/day |
|---|---|---|---|---|
| | Column 1 | Column 2 | Column 3 | Column 4 |
| 8 | Total Suspended Solids (TSS) | D | 130 | 48.7 |
| 9 | Total Lead | D | 1.14 | 0.329 |
| | Total Zinc | D | 1.41 | 0.492 |
| 25 | Oil and Grease | W | | |

Explanatory notes:

| | |
|---|---|
| ATG | Analytical Test Group |
| kg/day | kilograms per day |
| D | Daily monitoring requirement |
| W | Weekly monitoring requirement |

## Schedule 2
## PLANT: Stelco Hilton Works (Hamilton)

**Designated Process Effluent Sampling Points:**
0601, East Side Filter Plant Effluent
2100, #3 Bloom & Billet

| ATG | Parameter | Monitoring Frequency | Daily Plant Loading Limit kg/day | Monthly Average Plant Loading Limit kg/day |
|---|---|---|---|---|
| | Column 1 | Column 2 | Column 3 | Column 4 |
| 2 | Total Cyanide | W | 57.3 | 26.5 |
| 4a | Ammonia plus Ammonium | W | 1,880 | 754 |
| 8 | Total Suspended Solids (TSS) | D | 27,300 | 7,500 |
| 9 | Total Lead | W | 27.7 | 13.9 |
| | Total Zinc | W | 168 | 61.1 |
| | Total Chromium | W | 42.9 | 12.6 |
| 14 | Phenolics (4AAP) | W | 5.80 | 2.05 |
| 17 | Benzene | W | 0.729 | 0.251 |
| 19 | Benzo(a)pyrene | W | 0.846 | 0.292 |
| | Naphthalene | W | 2.02 | 0.699 |
| 25 | Oil and Grease | W | | |

Explanatory notes:

| | |
|---|---|
| ATG | Analytical Test Group |
| kg/day | kilograms per day |
| D | Daily monitoring requirement |
| W | Weekly monitoring requirement |

## Schedule 2
## PLANT: Stelco Hilton Works - #2 Rod Mill (Hamilton)

**Designated Process Effluent Sampling Point:**
1100, #2 Rod Mill Effluent

| ATG | Parameter | Monitoring Frequency | Daily Plant Loading Limit | Monthly Average Plant Loading Limit |
|---|---|---|---|---|
| | | | kg/day | kg/day |
| | Column 1 | Column 2 | Column 3 | Column 4 |
| 8 | Total Suspended Solids (TSS) | D | 1,600 | 431 |
| 25 | Oil and Grease | W | | |

Explanatory notes:

| | |
|---|---|
| ATG | Analytical Test Group |
| kg/day | kilograms per day |
| D | Daily monitoring requirement |
| W | Weekly monitoring requirement |

## Schedule 2
## PLANT: Stelco Lake Erie Works (Nanticoke)

**Designated Process Effluent Sampling Point:**
0400, Blowdown Treatment Plant Effluent

| ATG | Parameter | Monitoring Frequency | Daily Plant Loading Limit | Monthly Average Plant Loading Limit |
|---|---|---|---|---|
| | | | kg/day | kg/day |
| | Column 1 | Column 2 | Column 3 | Column 4 |
| 2 | Total Cyanide | W | 26.0 | 10.3 |
| 4a | Ammonia plus Ammonium | W | 21.8 | 9.88 |
| 8 | Total Suspended Solids (TSS) | D | 679 | 281 |
| 9 | Total Lead | W | 14.0 | 4.65 |
| | Total Zinc | W | 20.9 | 6.99 |
| 14 | Phenolics (4AAP) | W | 0.370 | 0.185 |
| 17 | Benzene | W | 0.0553 | 0.0184 |
| 19 | Benzo(a)pyrene | W | 0.0553 | 0.0184 |
| | Naphthalene | W | 0.0553 | 0.0184 |
| 25 | Oil and Grease | W | | |

Explanatory notes:

| | |
|---|---|
| ATG | Analytical Test Group |
| kg/day | kilograms per day |
| D | Daily monitoring requirement |
| W | Weekly monitoring requirement |

# Schedule 3
## Analytical Requirements at Plants with More Than One Process Effluent Sampling Point

### Schedule 3
### PLANT: Algoma Steel (Sault Ste. Marie)

| ATG | Parameter | Sampling Points | | | |
|---|---|---|---|---|---|
| | | 0100 | 0400 | 0700 | 1800 |
| | Column 1 | Column 2 | Column 3 | Column 4 | Column 5 |
| 2 | Total Cyanide | - | - | X | - |
| 4a | Ammonia plus Ammonium | - | - | X | - |
| 8 | Total Suspended Solids (TSS) | X | X | X | X |
| 9 | Total Lead | X | - | X | - |
| | Total Zinc | X | - | X | - |
| 14 | Phenolics (4AAP) | - | - | X | - |
| 17 | Benzene | - | - | X | - |
| 19 | Benzo(a)pyrene | - | - | X | - |
| | Naphthalene | - | - | X | - |
| 25 | Oil and Grease | X | X | X | X |

Explanatory notes:

| | |
|---|---|
| ATG | Analytical Test Group |
| X | means that the corresponding parameter in Column 1 is specified for the sampling point and is required to be monitored at the sampling point |

## Schedule 3
## PLANT: Dofasco (Hamilton)

| ATG | Parameter | Sampling Points | | | | |
|---|---|---|---|---|---|---|
| | | 0700 | 0800 | 0900 | 1101 | 2000 |
| | Column 1 | Column 2 | Column 3 | Column 4 | Column 5 | Column 6 |
| 2 | Total Cyanide | X | X | - | - | - |
| 4a | Ammonia plus Ammonium | X | X | - | - | - |
| 8 | Total Suspended Solids (TSS) | X | X | X | X | X |
| 9 | Total Lead | X | X | X | X | X |
| | Total Zinc | X | X | X | X | X |
| 14 | Phenolics (4AAP) | X | X | - | - | - |
| 17 | Benzene | X | - | - | - | - |
| 19 | Benzo(a)pyrene | X | - | - | - | - |
| | Naphthalene | X | - | - | - | - |
| 25 | Oil and Grease | X | - | - | X | X |

Explanatory notes:

| | |
|---|---|
| ATG | Analytical Test Group |
| X | means that the corresponding parameter in Column 1 is specified for the sampling point and is required to be monitored at the sampling point |

## Schedule 3
## PLANT: Stelco Hilton Works (Hamilton)

| ATG | Parameter | Sampling Points | |
|---|---|---|---|
| | | 2100 | 0601 |
| | Column 1 | Column 2 | Column 3 |
| 2 | Total Cyanide | - | X |
| 4a | Ammonia plus Ammonium | - | X |
| 8 | Total Suspended Solids (TSS) | X | X |
| 9 | Total Lead | - | X |
| | Total Zinc | - | X |
| | Total Chromium | - | X |
| 14 | Phenolics (4AAP) | - | X |
| 17 | Benzene | - | X |
| 19 | Benzo(a)pyrene | - | X |
| | Naphthalene | - | X |
| 25 | Oil and Grease | X | X |

Explanatory notes:

| | |
|---|---|
| ATG | Analytical Test Group |
| X | means that the corresponding parameter in Column 1 is specified for the sampling point and is required to be monitored at the sampling point |

## Schedule 4
## Merged Effluent: Designated Sampling Points, Monitoring Frequency

### Schedule 4
### PLANT: Atlas Specialty Steels (Welland)

**Designated Merged Effluent Sampling Point:**
0100, 42 Inch Sewer

| ATG | Parameter | Monitoring Frequency |
|---|---|---|
| | Column 1 | Column 2 |
| 8 | Total Suspended Solids (TSS) | W |
| 9 | Total Nickel | W |
| | Total Zinc | W |
| | Total Chromium | W |
| 25 | Oil and Grease | W |

Explanatory notes:

| | |
|---|---|
| ATG | Analytical Test Group |
| W | Weekly monitoring requirement |

## Schedule 4
## PLANT: Dofasco (Hamilton)

**Designated Merged Effluent Sampling Point:**
0400, West Bay Front Sewer

| ATG | Parameter | Monitoring Frequency |
|---|---|---|
| | Column 1 | Column 2 |
| 2 | Total Cyanide | W |
| 4a | Ammonia plus Ammonium | W |
| 8 | Total Suspended Solids (TSS) | W |
| 9 | Total Lead | W |
| | Total Zinc | W |
| 14 | Phenolics (4AAP) | W |
| 17 | Benzene | Q |
| 19 | Benzo(a)pyrene | Q |
| | Naphthalene | Q |
| 25 | Oil and Grease | W |

Explanatory notes:

| | |
|---|---|
| ATG | Analytical Test Group |
| W | Weekly monitoring requirement |
| Q | Quarterly monitoring requirement |

## Schedule 4
## PLANT: Stelco Hilton Works (Hamilton)

**Designated Merged Effluent Sampling Point:**
0400, North Outfall

| ATG | Parameter | Monitoring Frequency |
|---|---|---|
| | Column 1 | Column 2 |
| 8 | Total Suspended Solids (TSS) | W |
| 25 | Oil and Grease | W |

Explanatory notes:

| | |
|---|---|
| ATG | Analytical Test Group |
| W | Weekly monitoring requirement |

## Schedule 4
## PLANT: Stelco Lake Erie Works (Nanticoke)

**Designated Merged Effluent Sampling Point:**
0100, #4 Pond Discharge

| ATG | Parameter | Monitoring Frequency |
|---|---|---|
| | Column 1 | Column 2 |
| 2 | Total Cyanide | W |
| 4a | Ammonia plus Ammonium | W |
| 8 | Total Suspended Solids (TSS) | W |
| 9 | Total Lead | W |
| | Total Zinc | W |
| 14 | Phenolics (4AAP) | W |
| 17 | Benzene | Q |
| 19 | Benzo(a)pyrene | Q |
| | Naphthalene | Q |
| 25 | Oil and Grease | W |

Explanatory notes:

| | |
|---|---|
| ATG | Analytical Test Group |
| W | Weekly monitoring requirement |
| Q | Quarterly monitoring requirement |

## Schedule 5
## Cooling Water Effluent: Designated Sampling Points, Monitoring Frequency

### Schedule 5
### PLANT: Algoma Steel (Sault Ste. Marie)

**Designated Cooling Water Effluent Sampling Points:**
0200, 60 Inch Sewer
0300, 30 Inch Sewer
0500, Cold Mill 24 Inch Sewer
0800, Boiler House
1000, #2 Steelmaking
1500, Cold Mill 20 Inch Sewer
1600, Coke Oven Condenser

| ATG | Parameter | Monitoring Frequency | Sampling Points | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | 0200 | 0300 | 0500 | 0800 | 1000 | 1500 | 1600 |
| | Column 1 | Column 2 | Column 3 | Column 4 | Column 5 | Column 6 | Column 7 | Column 8 | Column 9 |
| 2 | Total Cyanide | W | X | X | - | - | - | - | X |
| 4a | Ammonia plus Ammonium | W | X | X | - | - | - | - | X |
| 8 | Total Suspended Solids (TSS) | W | X | X | X | X | X | X | X |
| 9 | Total Lead | W | X | X | X | - | X | X | - |
| | Total Zinc | W | X | X | X | - | X | X | - |
| 14 | Phenolics (4AAP) | W | X | X | - | - | - | - | X |
| 17 | Benzene | Q | - | - | - | - | - | - | X |
| 19 | Benzo(a)pyrene | Q | - | - | - | - | - | - | X |
| | Naphthalene | Q | - | - | - | - | - | - | X |
| 25 | Oil and Grease | W | X | X | X | X | X | X | X |

Explanatory notes:

| | |
|---|---|
| ATG | Analytical Test Group |
| W | Weekly monitoring requirement |
| Q | Quarterly monitoring requirement |
| X | means that the corresponding parameter in Column 1 is specified for the sampling point and is required to be monitored at the sampling point |

## Schedule 5
## PLANT: Dofasco (Hamilton)

**Designated Cooling Water Effluent Sampling Points:**
0100, East Boat Slip Sewer
0300, Boiler House Sewer #1
1200, Boiler House Sewer #2
1700, #2 Hot Mill/Melt Shop

| ATG | Parameter | Monitoring Frequency | Sampling Points | | | |
|---|---|---|---|---|---|---|
| | | | 0100 | 0300 | 1200 | 1700 |
| | Column 1 | Column 2 | Column 3 | Column 4 | Column 5 | Column 6 |
| 8 | Total Suspended Solids (TSS) | W | X | X | X | X |
| 9 | Total Lead | W | X | - | - | X |
| | Total Zinc | W | X | - | - | X |
| 25 | Oil and Grease | W | X | X | X | X |

Explanatory notes:

| | |
|---|---|
| ATG | Analytical Test Group |
| W | Weekly monitoring requirement |
| X | means that the corresponding parameter in Column 1 is specified for the sampling point and is required to be monitored at the sampling point |

## Schedule 5
## PLANT: Stelco Hilton Works (Hamilton)

**Designated Cooling Water Effluent Sampling Points:**
0100, West Side Open Cut
0200, Northwest Outfall
0602, #1 60 Inch Sewer

| ATG | Parameter | Monitoring Frequency | Sampling Points | | |
|---|---|---|---|---|---|
| | | | 0100 | 0200 | 0602 |
| | Column 1 | Column 2 | Column 3 | Column 4 | Column 5 |
| 2 | Total Cyanide | W | X | X | - |
| 4a | Ammonia plus Ammonium | W | X | X | - |
| 8 | Total Suspended Solids (TSS) | W | X | X | X |
| 9 | Total Zinc | W | X | X | - |
| 14 | Phenolics (4AAP) | W | X | X | - |
| 17 | Benzene | Q | X | X | - |
| 19 | Benzo(a)pyrene | Q | X | X | - |
| | Naphthalene | Q | X | X | - |
| 25 | Oil and Grease | W | X | X | X |

Explanatory notes:

| | |
|---|---|
| ATG | Analytical Test Group |
| W | Weekly monitoring requirement |
| Q | Quarterly monitoring requirement |
| X | means that the corresponding parameter in Column 1 is specified for the sampling point and is required to be monitored at the sampling point |

## Schedule 5
## PLANT: Stelco Hilton Works - #2 Rod Mill (Hamilton)

**Designated Cooling Water Effluent Sampling Point:**
2200, #2 Rod Mill

| ATG | Parameter | Monitoring Frequency | Sampling Point |
|---|---|---|---|
| | | | 2200 |
| | Column 1 | Column 2 | Column 3 |
| 8 | Total Suspended Solids (TSS) | W | X |
| 25 | Oil and Grease | W | X |

Explanatory notes:

| | |
|---|---|
| ATG | Analytical Test Group |
| W | Weekly monitoring requirement |
| X | means that the corresponding parameter in Column 1 is specified for the sampling point and is required to be monitored at the sampling point |

## Schedule 6
## Acute Lethality: Sampling Points

| Schedule 6 | |
|---|---|
| Plant Name | Sampling Point - Number and Description |
| Algoma Steel | 0100, Bar and Strip Lagoon Outfall (Process Effluent) |
| | 0200, 60 Inch Sewer (Cooling Water) |
| | 0300, 30 Inch Sewer (Cooling Water) |
| | 0400, #1 Tube Mill (Process Effluent) |
| | 0500, Cold Mill 24 Inch Sewer (Cooling Water) |
| | 0700, Main Filter Plant (Process Effluent) |
| | 0800, Boiler House (Cooling Water) |
| | 1000, #2 Steelmaking Cooling Water (Cooling Water) |
| | 1500, Cold Mill 20 Inch Sewer (Cooling Water) |
| | 1600, Coke Oven Condenser (Cooling Water) |
| | 1800, #2 Tube Mill (Process Effluent) |
| Atlas Specialty Steels | 0100, 42 Inch Sewer (Merged Effluent) |
| Dofasco | 0100, East Boat Slip Sewer (Cooling Water) |
| | 0300, Boiler House Sewer #1 (Cooling Water) |
| | 0400, West Bay Front Sewer (Merged Effluent) |
| | 1101, #1 Acid Regeneration Filter Discharge (Process Effluent) |
| | 1200, Boiler House Sewer #2 (Cooling Water) |
| | 1700, #2 Hot Mill/Melt Shop (Cooling Effluent) |
| | 2000, #2 Hot Mill Filter Plant (Process Effluent) |

## Schedule 6

| Plant Name | Sampling Point - Number and Description |
|---|---|
| Ivaco Rolling Mills Limited Partnership | 0900, Rod Mill Filter Effluent (Process Effluent) |
| Lake Ontario Steel Company | 0100, South Pond (Process Effluent) |
| Stelco Hilton Works | 0100, West Side Open Cut (Cooling Water) |
| | 0200, Northwest Outfall (Cooling Water) |
| | 0400, North Outfall (Merged Effluent) |
| | 0601, East Side Filter Plant (Process Effluent) |
| | 0602, #1 60 Inch Sewer (Cooling Water) |
| | 1100, #2 Rod Mill (Process Effluent) |
| | 2200, #2 Rod Mill (Cooling Water) |
| Stelco Lake Erie Works | 0100, #4 Pond Discharge (Merged Effluent) |

## Schedule 7
## Acute Lethality Testing: Sampling Points

| Schedule 7 | |
|---|---|
| Plant Name | Sampling Point - Number and Description |
| Atlas Specialty Steels | 0300, North Treatment Plant Effluent (Process Effluent) |
| Dofasco | 0700, Coke Plant Effluent (Process Effluent) |
| | 0800, Blast Furnace Recycle Blowdown (Process Effluent) |
| | 0900, Steelmaking Effluent (Process Effluent) |
| Stelco Hilton Works | 2100, #3 Bloom & Billet (Process Effluent) |
| Stelco Lake Erie Works | 0400, Blowdown Treatment Plant Effluent (Process Effluent) |

## Schedule 8
## Chronic Toxicity Testing: Sampling Points

| Schedule 8 | |
|---|---|
| Plant Name | Sampling Point - Number and Description |
| Algoma Steel | 0100, Bar and Strip Lagoon Outfall (Process Effluent) |
| | 0400, #1 Tube Mill (Process Effluent) |
| | 0700, Main Filter Plant (Process Effluent) |
| | 1800, #2 Tube Mill (Process Effluent) |
| Atlas Specialty Steels | 0100, 42 Inch Sewer (Merged Effluent) |
| Dofasco | 0400, West Bay Front Sewer (Merged Effluent) |
| | 1101, #1 Acid Regeneration Filter Discharge (Process Effluent) |
| | 2000, #1 Hot Mill Filter Plant (Process Effluent) |
| Ivaco Rolling Mills Limited Partnership | 0900, Rod Mill Filter Effluent (Process Effluent) |
| Lake Ontario Steel Company | 0100, South Pond (Process Effluent) |
| Stelco Hilton Works | 0400, North Outfall (Merged Effluent) |
| | 0601, East Side Filter Plant (Process Effluent) |
| | 1100, #2 Rod Mill (Process Effluent) |
| Stelco Lake Erie Works | 0100, #4 Pond Discharge (Merged Effluent) |

## Schedule 9
## Process Subcategories, Products and Reference Production Rate

### Schedule 9
### PLANT NAME: Algoma Steel (Sault Ste. Marie)

| Process Subcategory | Product | Reference Production Rate (tonnes/day) |
|---|---|---|
| Column 1 | Column 2 | Column 3 |
| Cokemaking Process | Metallurgical Coke | 2,994 |
| Ironmaking Process | Molten Iron | 6,441 |
| Steelmaking Process | Raw Steel | 6,577 |
| #1 Continuous Casting Process | Beams and Blooms | 935 |
| #2 Continuous Casting Process | Slabs | 5,642 |
| #1 & #2 Tube Mills | Seamless Tubes | 907 |
| Hotforming Process | Plate and Strip | 11,431 |
| Finishing Process | Pickled, Cold Rolled, Tempered Coils and Sheets | 1,470 |

### Schedule 9
### PLANT NAME: Atlas Specialty Steels (Welland)

| Process Subcategory | Product | Reference Production Rate (tonnes/day) |
|---|---|---|
| Column 1 | Column 2 | Column 3 |
| Vacuum Oxygen Degassing Process | Refined Steel | 680 |
| Continuous Casting Process | Billet and Blooms | 427 |
| Hotforming Process | Stainless, Rock Drill Steels | 427 |

## Schedule 9
## PLANT NAME: Dofasco (Hamilton)

| Process Subcategory<br>Column 1 | Product<br>Column 2 | Reference Production Rate (tonnes/day)<br>Column 3 |
|---|---|---|
| Cokemaking Process | Metallurgical Coke | 4,264 |
| Ironmaking Process | Molten Iron | 9,435 |
| Steelmaking Process | Raw Steel | 9,042 |
| Vacuum Degassing Process | Refined Steel | 904 |
| Continuous Casting Process | Slabs | 9,042 |
| Hotforming Process | Plates and Strip | 12,410 |

## Schedule 9
## PLANT NAME: Ivaco Rolling Mills Limited Partnership (L'Orignal)

| Process Subcategory<br>Column 1 | Product<br>Column 2 | Reference Production Rate (tonnes/day)<br>Column 3 |
|---|---|---|
| Continuous Casting Process | Billets | 1,701 |
| Hotforming Process | Rods, Wire | 2,500 |

## Schedule 9
## PLANT NAME: Lake Ontario Steel Company (Whitby)

| Process Subcategory | Product | Reference Production Rate (tonnes/day) |
|---|---|---|
| Column 1 | Column 2 | Column 3 |
| Continuous Casting Process | Billets | 3,818 |
| Hotforming Process | Structural Steel | 3,818 |

## Schedule 9
## PLANT NAME: Stelco Hilton Works (Hamilton)

| Process Subcategory | Product | Reference Production Rate (tonnes/day) |
|---|---|---|
| Column 1 | Column 2 | Column 3 |
| Cokemaking Process | Metallurgical Coke | 4,500 |
| Ironmaking Process | Molten Iron | 8,600 |
| Sintering Process | Sinter | 1,800 |
| Steelmaking Process | Raw Steel | 9,200 |
| Continuous Casting Process | Slabs | 9,200 |
| #3 Bloom & Billet | Bloom and Billet | 3,700 |
| Hotforming Process | Plates and Strip | 10,163 |
| Finishing Process | Pickled, Cold Rolled, Hot Coated, Tempered Coils and Sheets | 6,900 |

## Schedule 9
## PLANT NAME: Stelco Hilton Works - #2 Rod Mill (Hamilton)

| Process Subcategory | Product | Reference Production Rate (tonnes/day) |
|---|---|---|
| Column 1 | Column 2 | Column 3 |
| Hotforming Process | Rods | 2,721 |

## Schedule 9
## PLANT NAME: Stelco Lake Erie Works (Nanticoke)

| Process Subcategory | Product | Reference Production Rate (tonnes/day) |
|---|---|---|
| Column 1 | Column 2 | Column 3 |
| Cokemaking Process | Metallurgical Coke | 1,734 |
| Ironmaking Process | Molten Iron | 5,960 |
| Steelmaking Process | Raw Steel | 6,800 |
| Vacuum Degassing | Refined Steel | 6,800 |
| Continuous Casting Process | Slabs | 6,800 |
| Hotforming Process | Plates and Strip | 7,500 |

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